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Möckli

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[54] **PROCESS FOR DYEING KERATIN-CONTAINING FIBRES WITH CATIONIC DYES**

[75] Inventor: **Peter Möckli**, Sandgrubenstrasse, Switzerland

[73] Assignee: **Ciba Specialty Chemicals Corporation**, Tarrytown, N.Y.

[21] Appl. No.: **756,448**

[22] Filed: **Nov. 26, 1996**

Related U.S. Application Data

[63] Continuation of Ser. No. 392,783, filed as PCT/EP94/02077, Jun. 27, 1994, abandoned.

[30] **Foreign Application Priority Data**

Jul. 5, 1993 [CH] Switzerland 2020/93

[51] **Int. Cl.**[6] **A61K 7/13**

[52] **U.S. Cl.** **8/426**; 8/568; 8/573; 8/639; 8/655; 8/657; 8/659; 8/692

[58] **Field of Search** 8/404, 405, 428, 8/565, 568, 570, 571, 572, 573, 670, 690, 691, 692, 916, 917, 639, 655, 657, 659

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Primary Examiner—Paul Lieberman
Assistant Examiner—Caroline L. Dusheck
Attorney, Agent, or Firm—Kevin T. Mansfield

[57] **ABSTRACT**

Keratin-containing fibres, in particular human hair, are dyed using dyes of formulae (1) to (6) indicated in claim 1. These dyes make it possible to dye by the trichromatic principle even in dark shades.

22 Claims, No Drawings

PROCESS FOR DYEING KERATIN-CONTAINING FIBRES WITH CATIONIC DYES

This is a continuation of application Ser. No. 08/392,783, granted 35 USC 371 filing date of Feb. 28, 1995, now abandoned, originally International application PCT/EP 94/02077 filed Jun. 27, 1994.

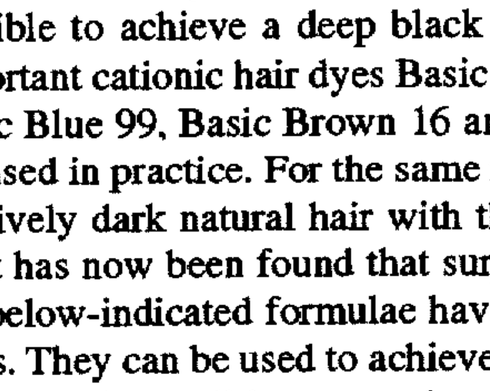
The present invention relates to a process for dyeing keratin-containing fibres, in particular human hair, with cationic dyes.

By far the largest proportion of all hair dyeings are carried out, even today, using so-called "oxidation colours", which involves applying small, colourless precursor molecules to the hair and reacting them by an oxidation process to form larger, coloured molecules. Although this produces the most durable ("permanent") colourings, increasing reservations are being voiced about possible toxicological risks posed not only by the substances used as starting materials but also by the oxidation intermediate and end products, whose precise composition is virtually uncontrollable. Further disadvantages are the relatively complicated use and in particular also the hair damage due to the aggressive chemicals used.

The other, so-called "semipermanent" and "temporary" colourings involve the use of ready-prepared dyes, primarily uncharged disperse dyes and relatively sparingly water-soluble acid dyes. Cationic dyes, by contrast, play only a very minor part. As the terms "semipermanent" and "temporary" indicate, these colourings only have a medium to poor fastness level. Especially the cationic dyes have a reputation for poor hydrolysis and light resistance and for uneven colouring of the hair, for example between root and tip (see: John F. Corbett: The Chemistry of Hair-care Products, JSDC August 1976, p. 290). In addition, the known cationic dyes have an insufficient build-up; i.e., even if increased amounts are used, it is impossible to exceed a certain, relatively low, colour strength. For instance, it is not possible to achieve a deep black coloration with the most important cationic hair dyes Basic Yellow 57, Basic Red 76, Basic Blue 99, Basic Brown 16 and Basic Brown 17 which are used in practice. For the same reason it is difficult to tint relatively dark natural hair with these dyes.

It has now been found that surprisingly cationic dyes of the below-indicated formulae have none of these disadvantages. They can be used to achieve in a very simple way and under gentle conditions very deep dyeings having excellent light, shampooing and crock fastness properties. Owing to their extremely clean shades, they also extend the range of possible mixed shades considerably, especially in the direction of the increasingly important brilliant fashion colours.

The present invention accordingly provides a process for dyeing keratin-containing fibres, which comprises treating the fibres with a dye of the formula



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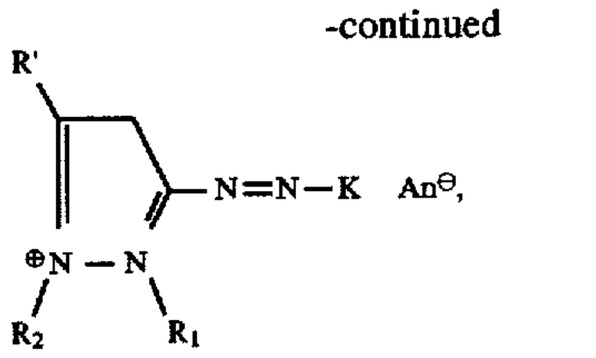

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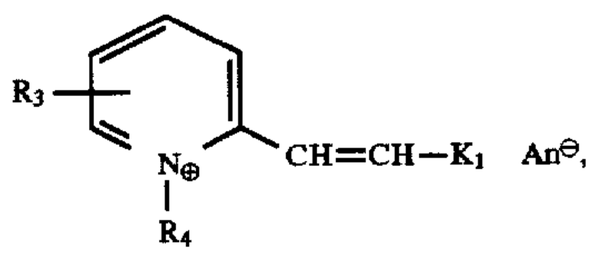

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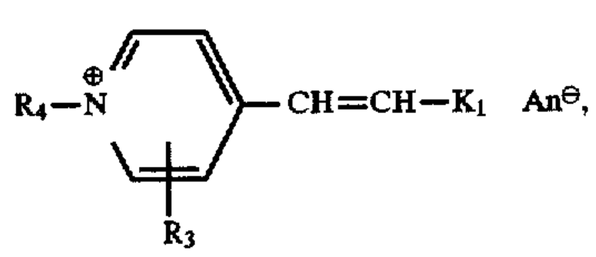

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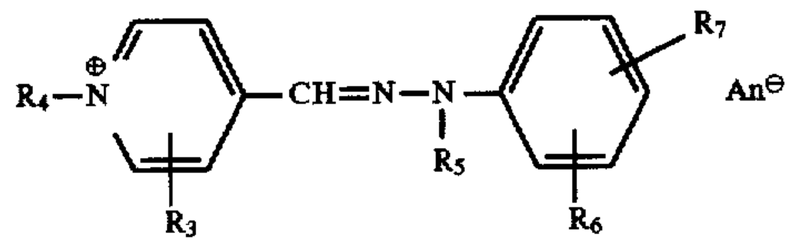

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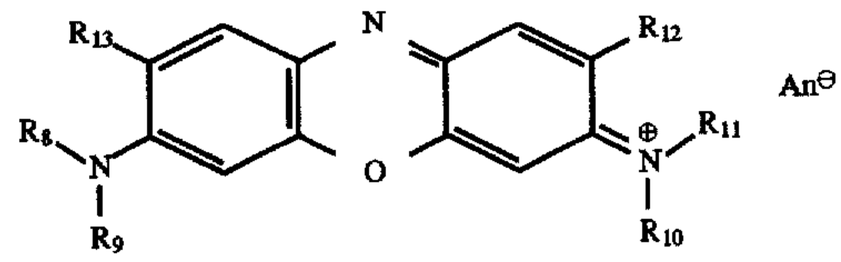
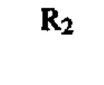
or



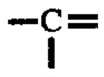
(6)

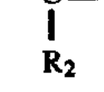
where

X is —O—, —S— or



Y is —CH=,





—N=,

R is hydrogen, C_1–C_4alkyl, Cl or nitro,

R' is hydrogen, C_1–C_4alkyl, Cl, nitro, amino, C_1–C_4monoalkylamino or di-C_1–C_4alkylamino,

R_1 and R_2 are each independently of the other unsubstituted or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl,

R_3 is hydrogen, C_1–C_4alkyl or CN,

R_4 is unsubstituted or OH— or CN-substituted C_1–C_4alkyl,

R_5 is hydrogen or C_1–C_4alkyl,

R_6 and R_7 are each independently of the other hydrogen, C_1–C_4alkyl or C_1–C_4alkoxy, or

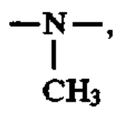
R_5 and R_6 are together with the nitrogen and carbon atoms joining them together a 5- or 6-membered ring,

R_8, R_9, R_{10} and R_{11} are each independently of the others hydrogen or C_1–C_4alkyl, with the proviso that at least one of these 4 substituents is C_1–C_4alkyl and that not all four substituents are ethyl,

R_{12} and R_{13} are each independently of the other hydrogen, C_1–C_4alkyl or C_1–C_4alkoxy,

K is the radical of a coupling component of the aniline or phenol series or the radical of a heterocyclic coupling component.

K_1 is the radical of an aromatic or heterocyclic amine, and $An^{\ominus}$ is a colourless anion, with the proviso that, in the dyes of the formula (1), K is not a radical of N,N-dimethylaniline when X is



Y is —N= and R and R_1 are each methyl.

For the purposes of the present invention, alkyl radicals are generally straight-chain or branched C_1–C_4alkyl groups. Suitable are for example methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl or tert-butyl.

Suitable alkoxy radicals are those having 1 to 4 carbon atoms, e.g. methoxy, ethoxy, propoxy, isopropoxy, n-butoxy, isobutoxy or tert-butoxy.

Halogen is to be understood as meaning fluorine, bromine, iodine or in particular chlorine.

If R_5 and R_6 are combined with the nitrogen atom and two carbon atoms joining them together into a 5- or 6-membered ring, this ring may contain a further heteroatom, for example oxygen or sulfur. Moreover, the ring may be substituted, for example by hydroxyl, alkoxy, alkyl, halogen, CN or phenyl, or carry a further fused-on benzene ring. Preferred rings formed by R_5, R_6, the linked carbon atoms and the nitrogen atom are pyrroline, dihydrooxazine and di- or tetrahydropyridine rings carrying 0 to 4 methyl groups.

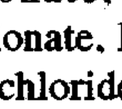
Suitable anions $An^{\ominus}$ include organic as well as inorganic anions, for example chloride, bromide, sulfate, hydrogensulfate, methosulfate, phosphate, borotetrafluoride, carbonate, bicarbonate, oxalate, formate, acetate, propionate, lactate or complex anions, such as the anion of zinc chloride double salts.

The anion is generally given by the method of preparation. Preferred anions are chloride, sulfate, hydrogensulfate, methosulfate, phosphate, formate, acetate or lactate.

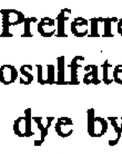
To dye by the process of the invention it is preferable to use a dye of the formula (1) where R' is hydrogen, C_1–C_2alkyl, amino, C_1–C_2monoalkylamino or di-C_1–C_2alkylamino or a dye of the formula (1) where R_1 is unsubstituted C_1–C_4alkyl.

It is likewise preferable to use dyes of the formula (2) where R is hydrogen or C_1–C_4alkyl or a dye of the formula (2) where R_1 is unsubstituted C_1–C_4alkyl.

Of the dyes of the formula (1), preference is given to those where X is

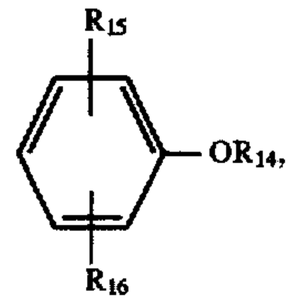


and especially those where X is



and Y is —CH=.

In the dyes of the formula (1), K is in particular the radical of a coupling component of the formula



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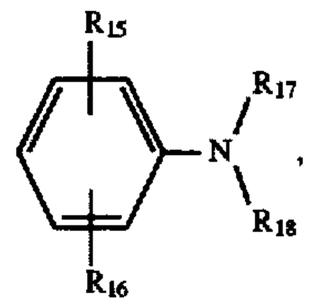

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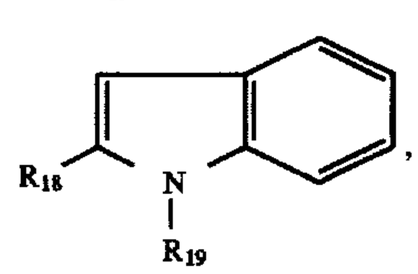

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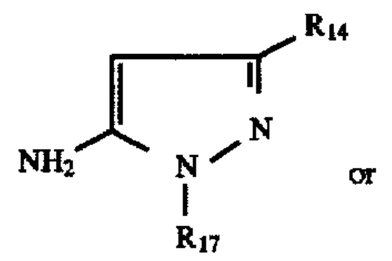

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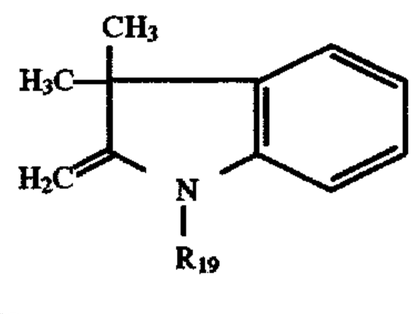


(11)

where

R_{14} is hydrogen or unsubstituted or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl,

R_{15} and R_{16} are each independently of the other hydrogen, C_1–C_4alkyl, C_1–C_4alkoxy or halogen,

R_{17} and R_{18} are each independently of the other hydrogen, unsubstituted or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl, or

R_{17} and R_{18} are together with the nitrogen atom joining them together a 5- or 6-membered ring, or

R_{15} and R_{17} are together with the nitrogen and carbon atoms joining them together a 5- or 6-membered ring, or

R_{16} and R_{18} are together with the nitrogen and carbon atoms joining them together a 5- or 6-membered ring, and

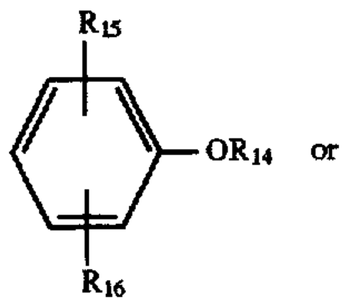
R_{19} is hydrogen or unsubstituted or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl.

If R_{17} and R_{18} are to combine with the nitrogen atom joining them together into a 5- or 6-membered ring, this ring is in particular a pyrrolidine, piperidine, morpholine or piperazine ring. These rings can be further substituted, for example by C_1–C_4alkyl or C_1–C_4alkoxy. Preference, however, is given to the unsubstituted rings.

If R_{15} and R_{17} or R_{16} and R_{18} are combined with the nitrogen atom and the two carbon atoms joining them together into a 5- or 6-membered ring, this ring may contain a further heteroatom, for example oxygen or sulfur. Moreover, the ring may be substituted, for example by hydroxyl, alkoxy, alkyl, halogen or CN, or carry a further fused-on benzene ring. Preferred rings formed by R_{15} and R_{17} or R_{16} and R_{18} and the carbon atoms joining them together and the nitrogen atom are pyrroline, dihydroox-

azine and di- or tetrahydropyridine rings carrying 0 to 4 methyl groups.

In particular K is the radical of a coupling component of the formula



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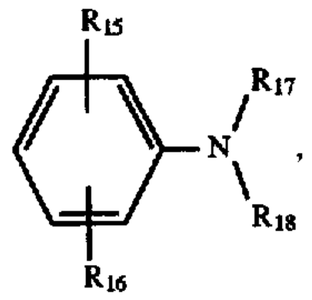


(8)

where

R_{14} is hydrogen or unsubstituted C_1–C_4alkyl,

R_{15} and R_{16} are each independently of the other hydrogen, C_1–C_4alkyl, C_1–C_4alkoxy or halogen,

R_{17} and R_{18} are each independently of the other hydrogen or unsubstituted C_1–C_4alkyl, or

R_{17} and R_{18} are together with the nitrogen atom joining them together a pyrrolidine, piperidine, morpholine or piperazine ring, or

R_{15} and R_{17} are together with the nitrogen and carbon atom joining them together a pyrrolidine, piperidine, morpholine or piperazine ring, or

R_{16} and R_{18} are together with the nitrogen and carbon atom joining them together a pyrrolidine, piperidine, morpholine or piperazine ring, and

R_{19} is hydrogen or unsubstituted C_1–C_4alkyl.

Of very particular interest for the process of the invention are dyes of the formula (1) or (2) where K is the radical of a coupling component of the formula (7) or (8) where

R_{14} is methyl or ethyl,

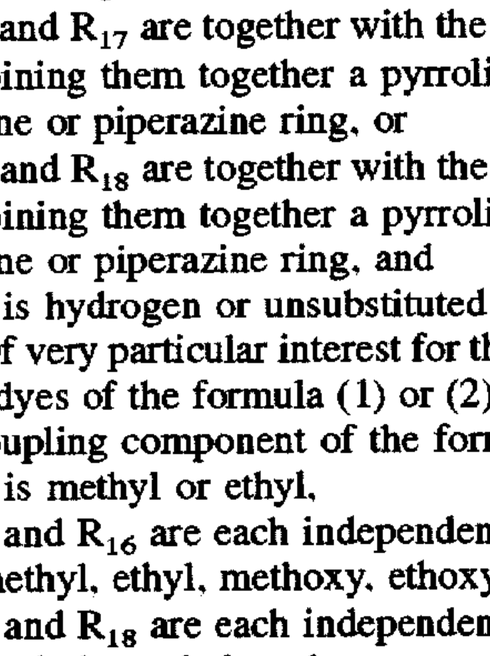
R_{15} and R_{16} are each independently of the other hydrogen, methyl, ethyl, methoxy, ethoxy or chlorine,

R_{17} and R_{18} are each independently of the other hydrogen, methyl or ethyl, and

R_{19} is hydrogen, methyl or ethyl.

Preference is also given to using a dye of the formula (3), (4) or (5) where R_3 is hydrogen or methyl or a dye of the formula (3), (4) or (5) where R_4 is unsubstituted or hydroxyl-substituted C_1–C_4alkyl, in particular methyl.

In the dyes of the formula (3) and (4), K_1 is in particular the radical of an amine of the formula



(12)

(13)

(14)

where

R_{15} and R_{16} are each independently of the other hydrogen, C_1–C_4alkyl, C_1–C_4alkoxy or halogen,

R_{17} and R_{18} are each independently of the other hydrogen, unsubstituted or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl, or

R_{17} and R_{18} are together with the nitrogen atom joining them together a 5- or 6-membered ring, or

R_{15} and R_{17} are together with the nitrogen and carbon atoms joining them together a 5- or 6-membered ring, or

R_{16} and R_{18} are together with the nitrogen and carbon atoms joining them together a 5- or 6-membered ring, and

R_{19} is hydrogen or unsubstituted or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl, and in particular the radical of an amine of the formula (12), (13) or (14), where

R_{15} and R_{16} are each independently of the other hydrogen, methyl, ethyl, methoxy, ethoxy or chlorine, or

R_{15} and R_{17} are together with the nitrogen and carbon atoms joining them together a pyrrolidine, piperidine, morpholine or piperazine ring,

R_{17} and R_{18} are each independently of the other hydrogen, methyl or ethyl, and

R_{19} is hydrogen, methyl or ethyl.

If the process of the invention is carried out using a dye of the formula (5), it is in particular a dye of the formula (5) where

R_5 is hydrogen or methyl and R_6 and R_7 are each independently of the other hydrogen, C_1–C_2alkyl or C_1–C_2alkoxy, or

R_5 and R_6 are together with the nitrogen and carbon atoms joining them together a pyrrolidine, piperidine, morpholine or piperazine ring.

Of the dyes of the formula (6), preference is given to using those where

R_8, R_9, R_{10} and R_{11} are each independently of the others hydrogen or C_1–C_2alkyl, with the proviso that at least one of these 4 substituents is C_1–C_2alkyl and that not all four substituents are ethyl, and

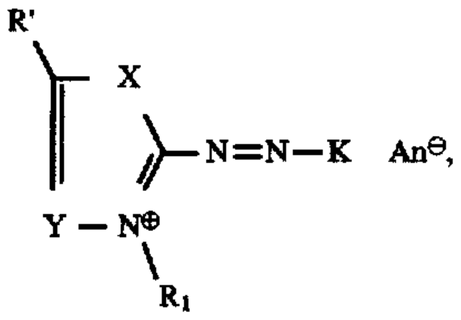
R_{12} and R_{13} are each independently of the other hydrogen, C_1–C_2alkyl or C_1–C_2alkoxy.

The dyes used according to the invention are known or can be prepared in a manner known per se.

The present invention furthermore provides a process for dyeing keratin-containing fibres, which comprises treating the fibres with a mixture of at least two cationic dyes having a delocalized positive charge and a cation weight below 300, preferably below 280.

Preference is given to using a mixture of at least three cationic dyes with a delocalized positive charge and a cation weight below 280 and in particular a mixture of a yellow, a red and a blue cationic dye with delocalized positive charge and a cation weight below 280.

A very particularly preferred embodiment of the novel process for dyeing keratin-containing fibres comprises treating the fibres with a mixture of at least two cationic dyes of the formula



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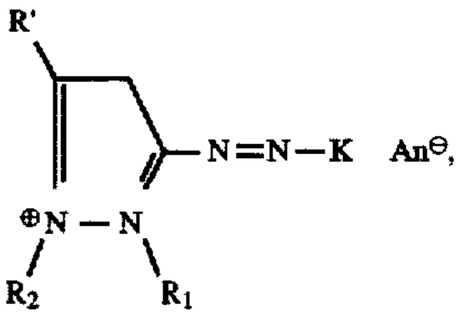

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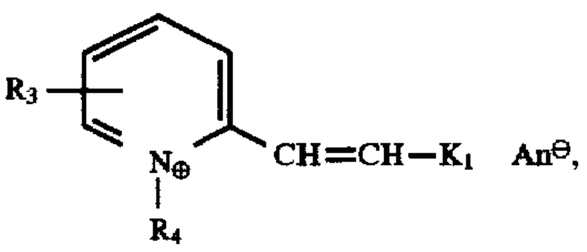

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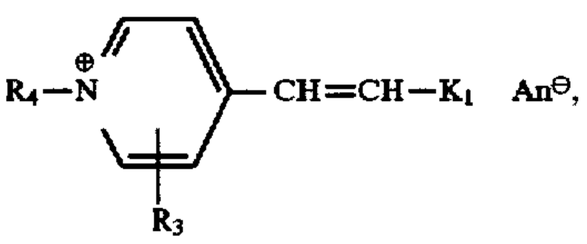

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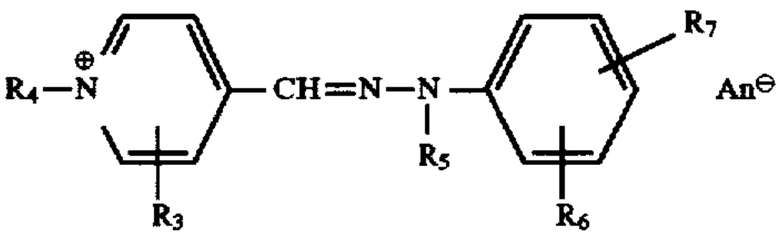
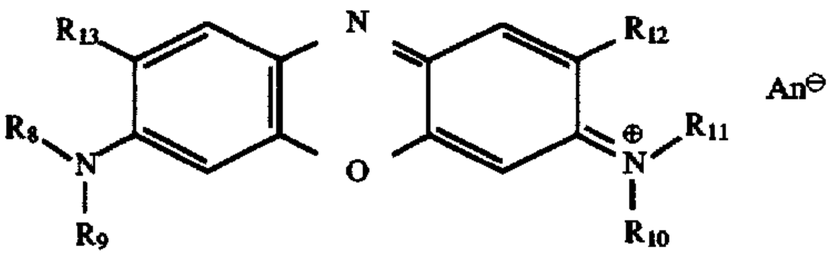


(5)

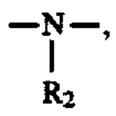
or



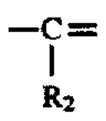
(6)

where

X is —O—, —S—, or



Y is —CH=,



or —N=,

R is hydrogen, C_1–C_4alkyl, Cl or nitro,

R' is hydrogen, C_1–C_4alkyl, Cl, nitro, amino, C_1–C_4monoalkylamino or di-C_1–C_4alkylamino,

R_1 and R_2 are each independently of the other unsubstituted or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl,

R_3 is hydrogen, C_1–C_4alkyl or CN,

R_4 is unsubstituted or OH— or CN-substituted C_1–C_4alkyl,

R_5 is hydrogen or C_1–C_4alkyl,

R_6 and R_7 are each independently of the other hydrogen, C_1–C_4alkyl or C_1–C_4alkoxy, or

R_5 and R_6 are together with the nitrogen and carbon atoms joining them together a 5- or 6-membered ring,

R_8, R_9, R_{10} and R_{11} are each independently of the others hydrogen or C_1–C_4alkyl,

R_{12} and R_{13} are each independently of the other hydrogen, C_1–C_4alkyl or C_1–C_4alkoxy,

K is the radical of a coupling component of the aniline series or the radical of a heterocyclic coupling component,

K_1 is the radical of an aromatic or heterocyclic amine, and

$An^{\ominus}$ is a colourless anion.

The process of the invention is suitable for dyeing furs and also animal and human hair, especially live human hair and domestic animals' hair. As a consequence of the high affinity and the good water solubility of the dyes used, it is possible to do the dyeing at room temperature from aqueous solutions without any assistants whatsoever.

However, it is also possible to use any assistants customary for cationic dyes used in the dyeing of hair, for example wetting agents, swelling agents, penetration aids or scents. In addition, the dyes can be incorporated into shampoos, creams, gels or pastes. Such cosmetic formulations for dyeing hair comprising at least one dye of the above-indicated formulae (1) to (6) and also assistants form a further part of the subject-matter of the present invention.

It has been found that the dyeing effect of the dyes used depends relatively little on the formulation of the dyes.

A particular advantage of the dyes used according to the invention for dyeing hair is that, owing to the good build-up of the dyes, the colourings can be prepared by the trichromatic principle; that is, it is possible by using a yellow, a red and a blue dye in suitable mixtures of these dyes to achieve virtually all shades. In addition, exact prediction of the shades obtained is possible, which is not the case with the so-called "oxidation dyes" owing to the varying composition of the end products.

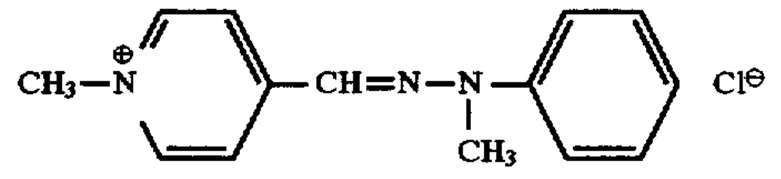
Using colorimetric methods of measurement it is also possible to obtain on natural, unbleached hair predicted shades having regard to the hair's natural colour by determining its yellow, red and blue content and deducting it from the recipe of the desired shade. This is not feasible with the hair dyes previously used.

The colourings obtained are crock-, water-, wash- and light-fast and stable to permanent-deformation agents, for example thioglycolic acid.

The Examples which follow illustrate the invention. Parts and percentages are by weight. The temperatures are given in degrees Celsius.

EXAMPLE 1

A braid-sewn strand of blond, natural, untreated human hair is dyed at 25° C. for 5 minutes in a conventional manner with a dye emulsion containing 0.1% of the dye of the formula



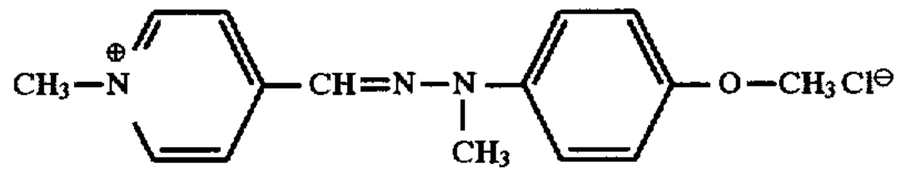
3.5% of Cetearyl Alcohol
1.0% of Ceteareth 80
0.5% of glyceryl mono-di-stearate
3.0% of stearamide DEA
1.0% of stearamphopropylsulfonate
0.5% of polyquaternium-6 and
water to 100%.

Then the hair is thoroughly rinsed with water and air-dried. The result is an intensive brilliant yellow colouring

which is many times stronger than a colouring prepared with Basic Yellow 57 in the same way. The light, shampooing and friction fastness properties of the colouring according to the invention are excellent.

EXAMPLE 2

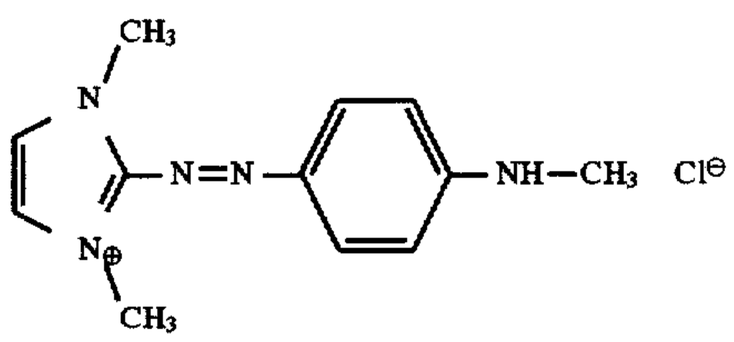
Example 1 is repeated with the dye of the formula



affording an intensively golden yellow colouring with likewise excellent fastness properties.

EXAMPLE 3

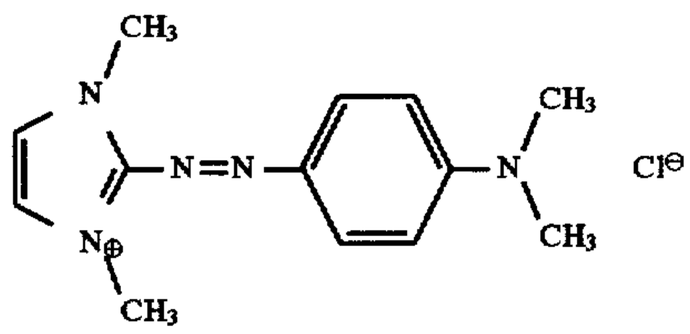
A 1% solution of the dye of the formula



in a surfactant base containing 10% of cocoamphoglycinate and 90% of water is applied to Chinese, bleached yak hair at 25° C. for 5 minutes, and then the hair is thoroughly rinsed and air-dried. The intensively scarlet red colouring obtained is many times stronger than a comparative dyeing with Basic Red 76 and also of distinctly better light fastness.

EXAMPLE 4

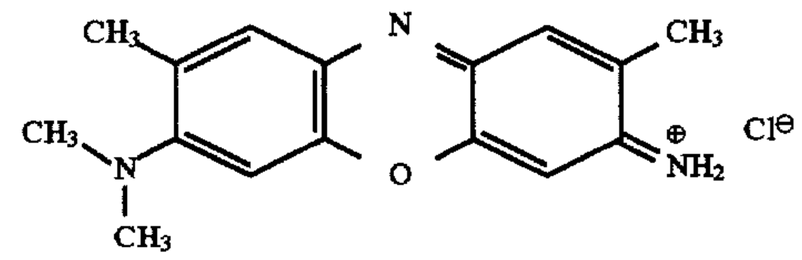
A strand of medium brown, untreated human hair is dyed for 5 minutes at room temperature with a dye emulsion containing 0.1% of the dye of the formula



and otherwise having the same composition as the dye emulsion of Example 1. Then the strand of hair is thoroughly rinsed with water and air-dried. The result is a very attractive chestnut-brown shade of the kind which is frequently desired. This shade is impossible to achieve with Basic Red 76 on account of the insufficient build-up of this dye.

EXAMPLE 5

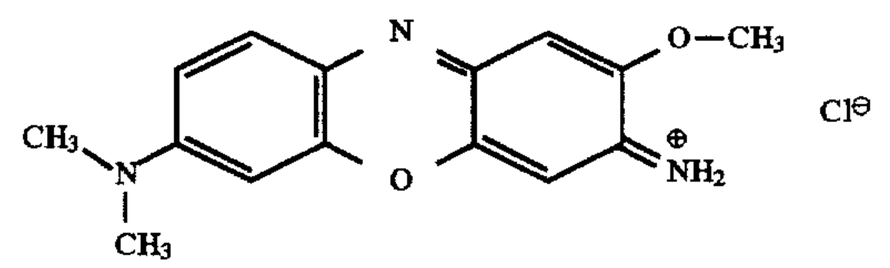
A strand of bleached yak hair is dyed for 5 minutes at 25° C. with a dye emulsion which contains 0.1% of the dye of the formula



and otherwise has the same composition as the dye emulsion of Example 3. Then the strand of hair is thoroughly rinsed with water and air-dried. The blue colouring obtained is very significantly stronger and more brilliant than a dyeing with Basic Blue 99 prepared in the same way.

EXAMPLE 6

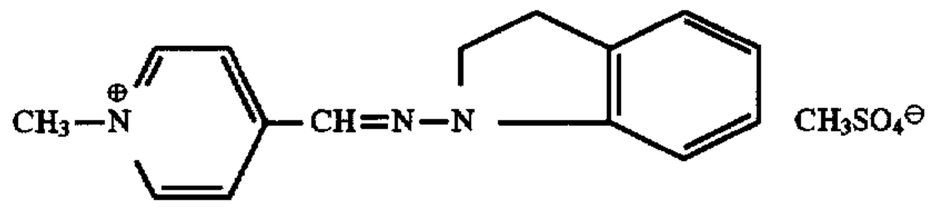
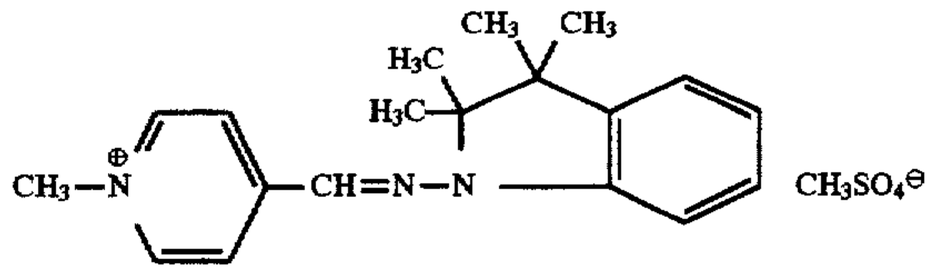
Example 4 is repeated with the red dye replaced by the blue dye of the formula



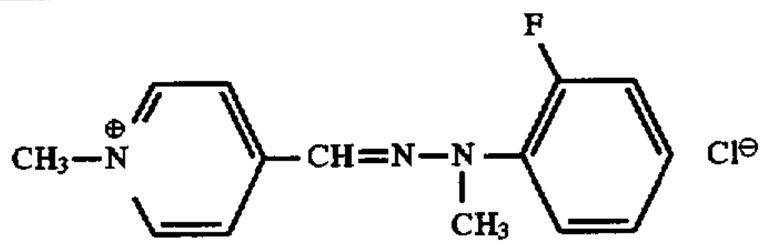
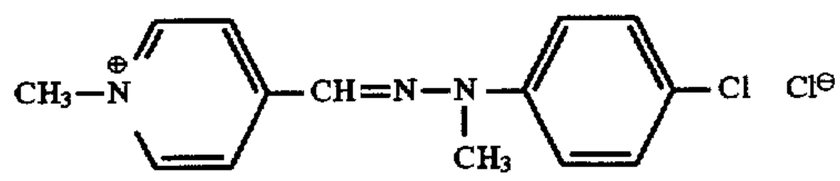
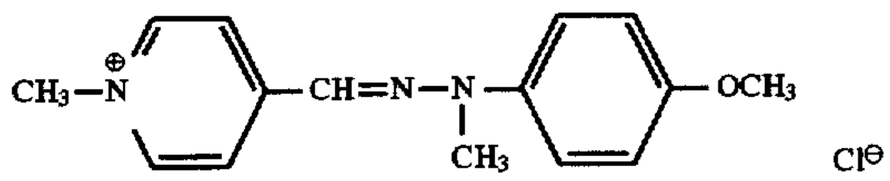
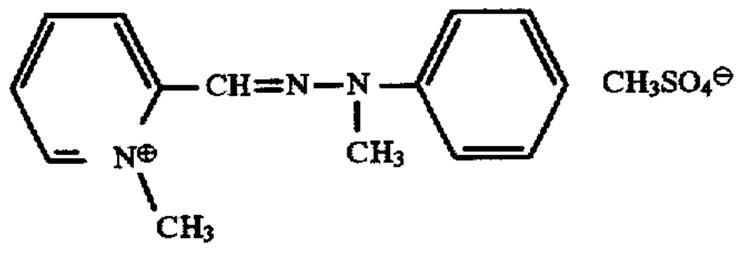
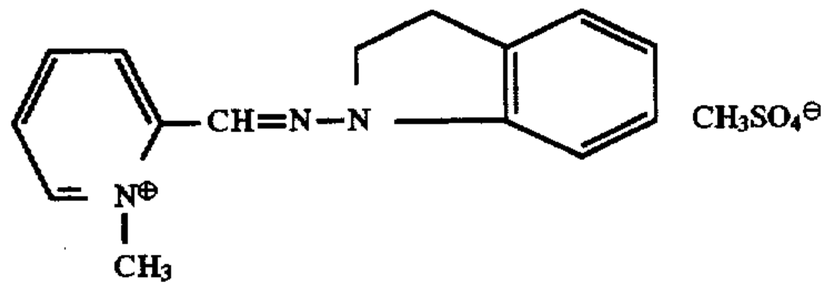
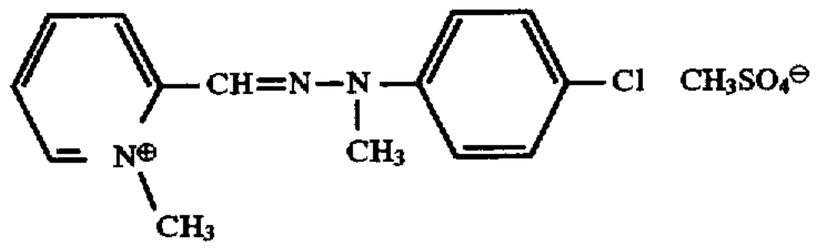
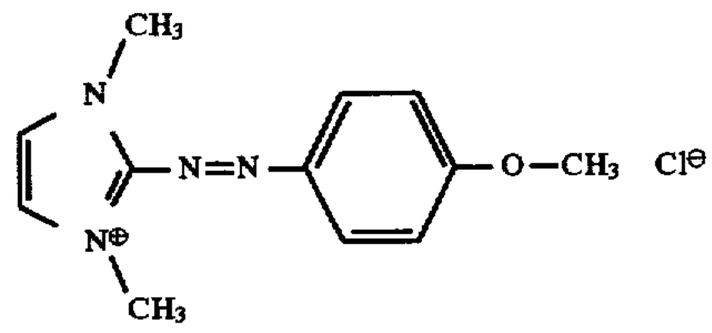
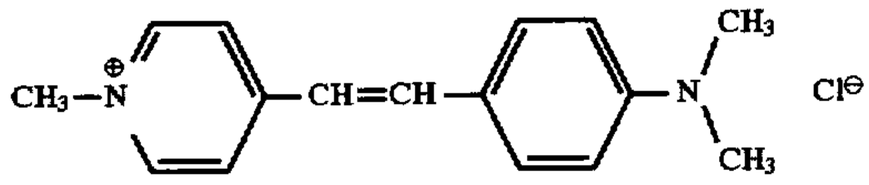
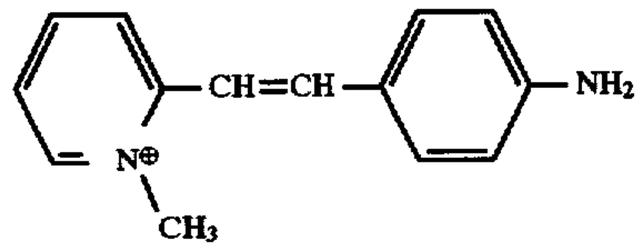
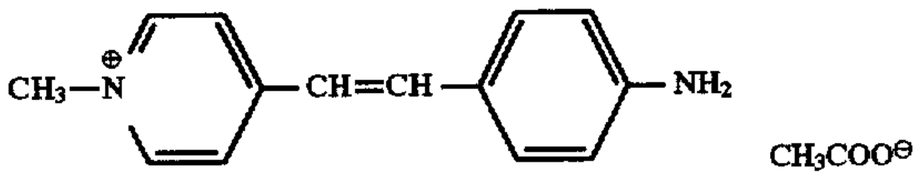
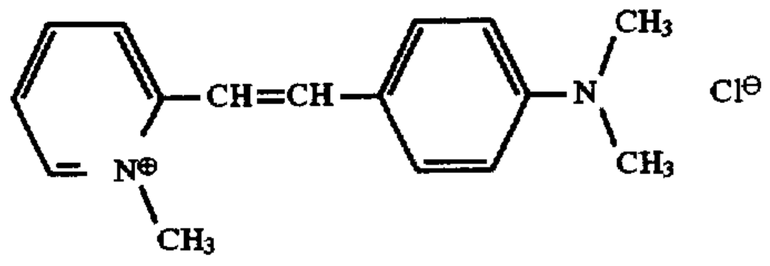
This shifts the original brown of the hair to a mattish brown hue which hides very well undesirable rust-red shades as frequently obtained following oxidation dyeings and lightenings. The scope for these tinting uses is much less with Basic Blue 99.

EXAMPLES 7–70

The method of Examples 1–3 is applied with the dyes listed below in the table, affording colourings on the hair in the specified hues.

Example	Dye	Hue
7		yellow
8		yellow

-continued

Example	Dye	Hue
9		yellow
10		yellow
11		yellow
12		yellow
13		yellow
14		yellow
15		yellow
16		orange
17		greenish yellow
18		greenish yellow
19		orange

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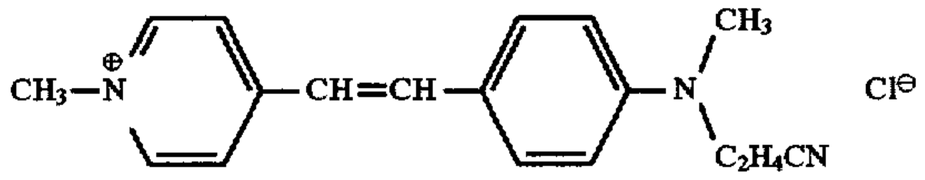
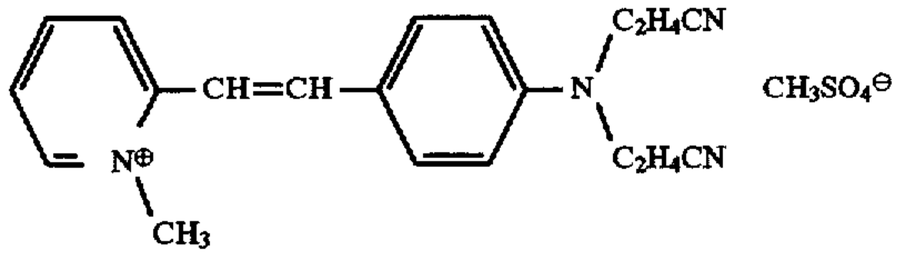
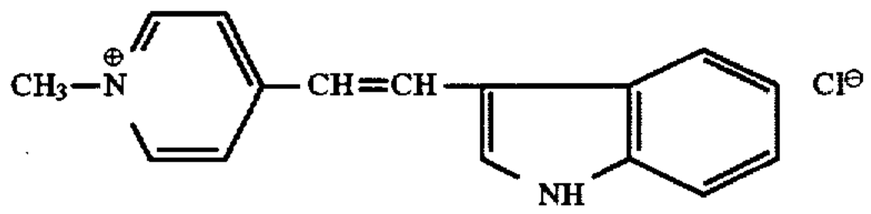
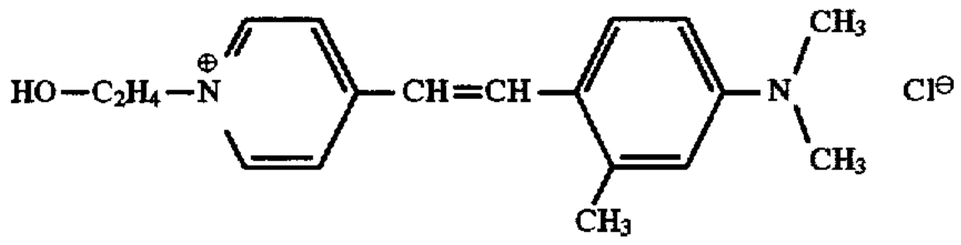
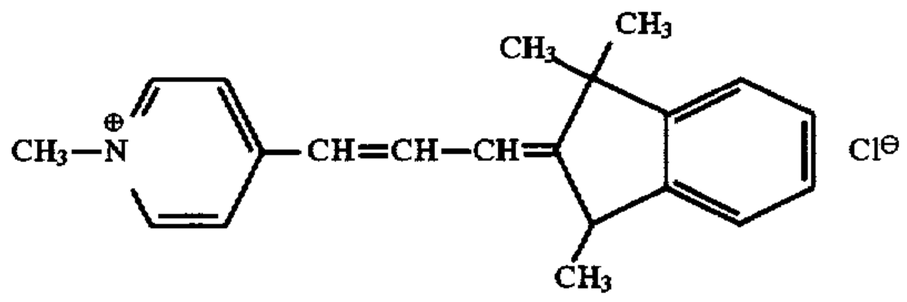
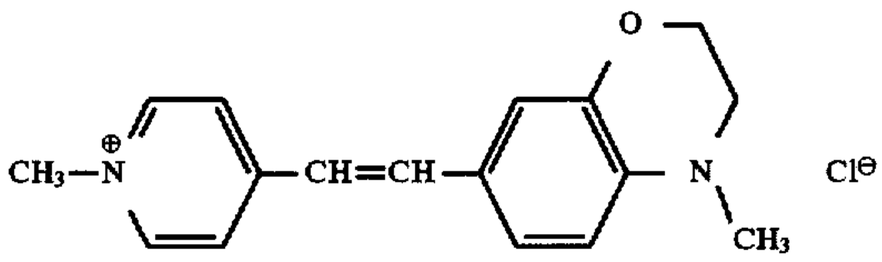
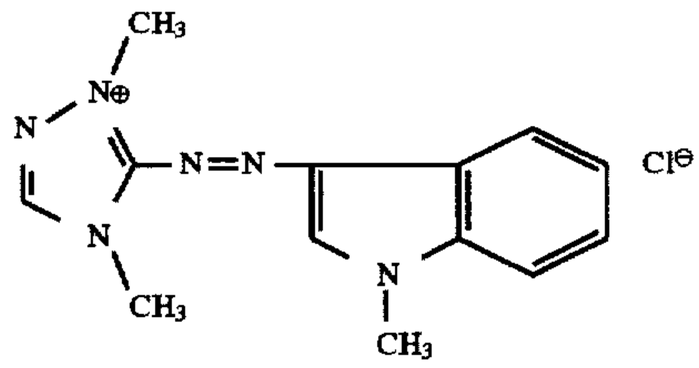
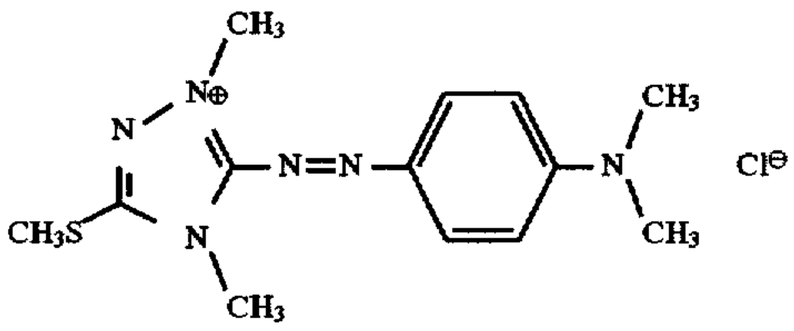
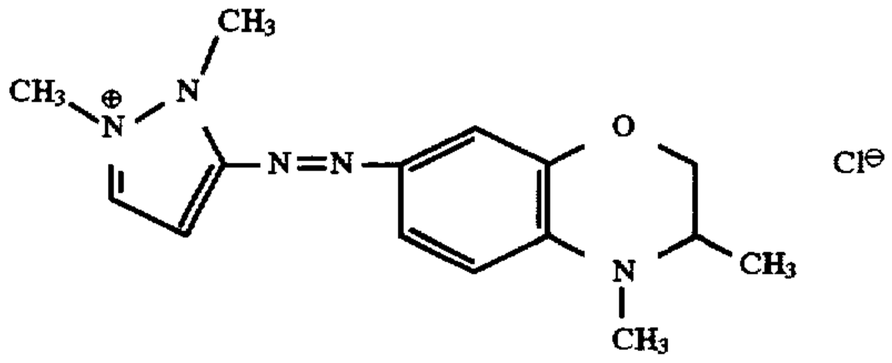
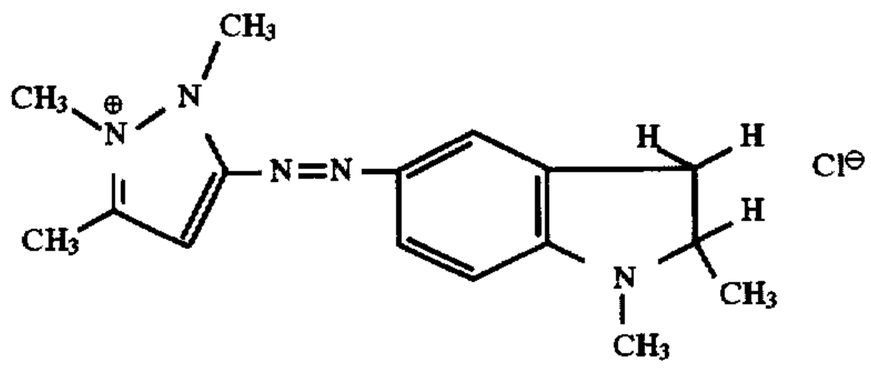
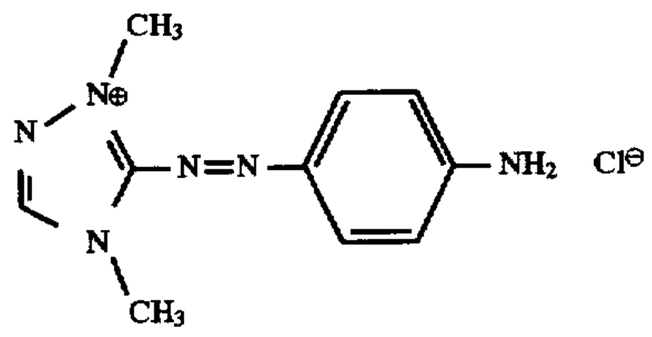
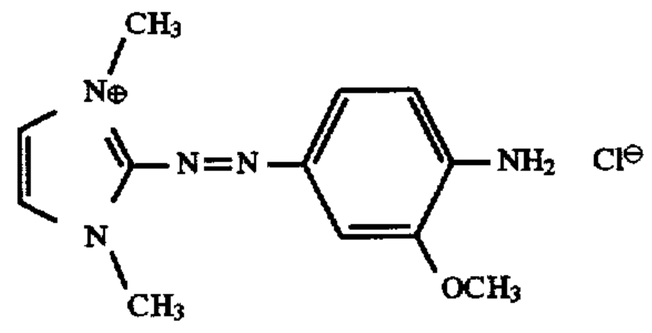
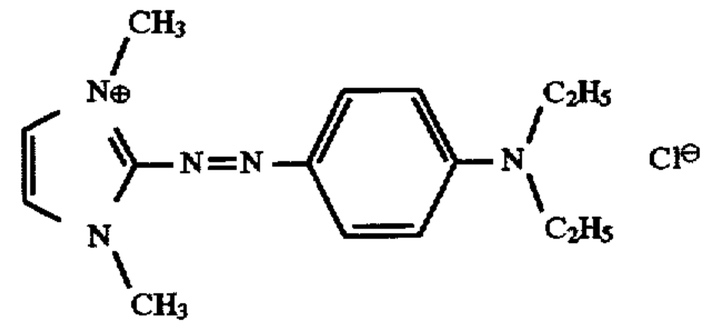
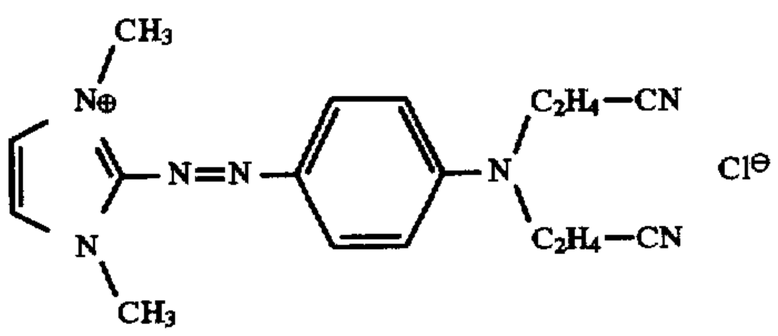
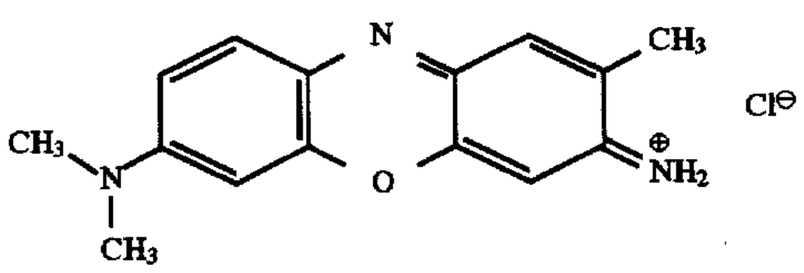
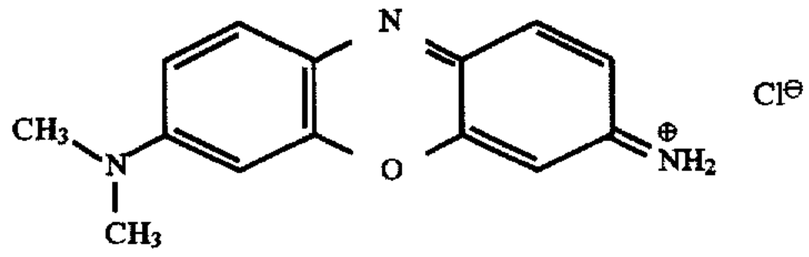
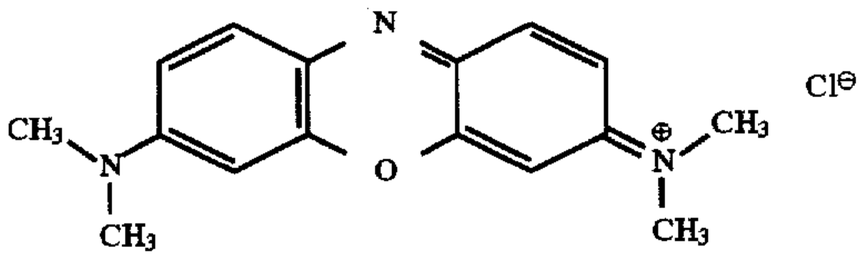
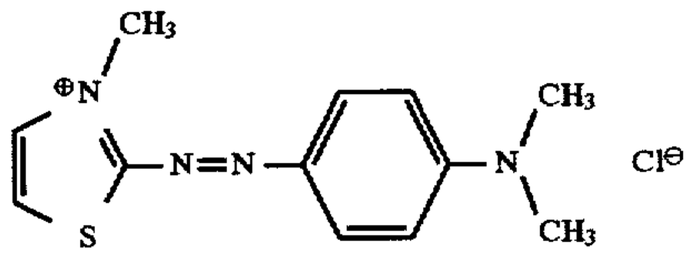
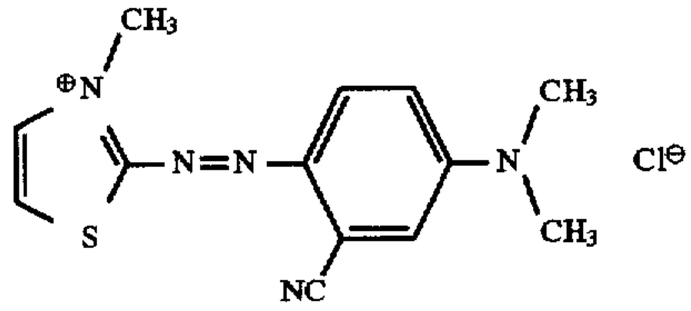
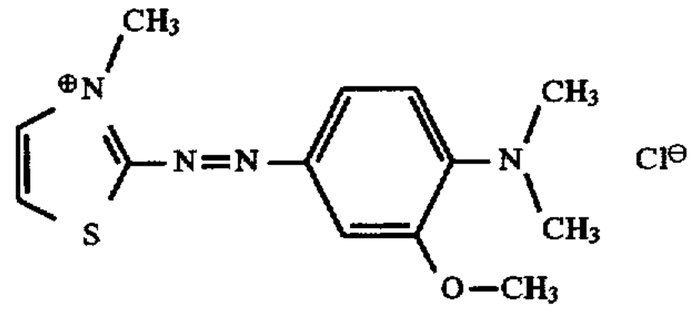
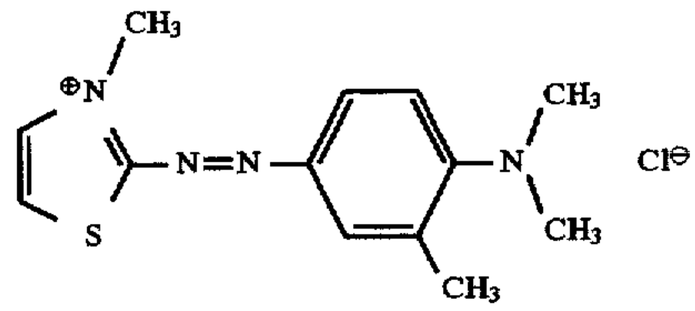
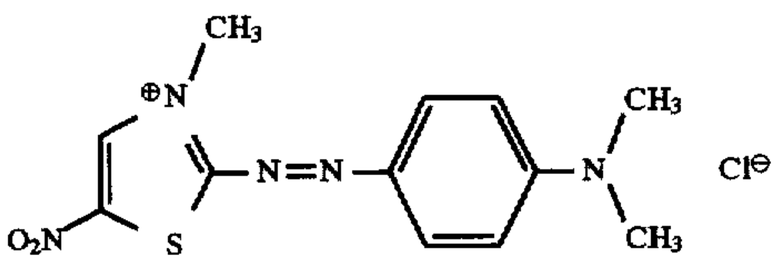
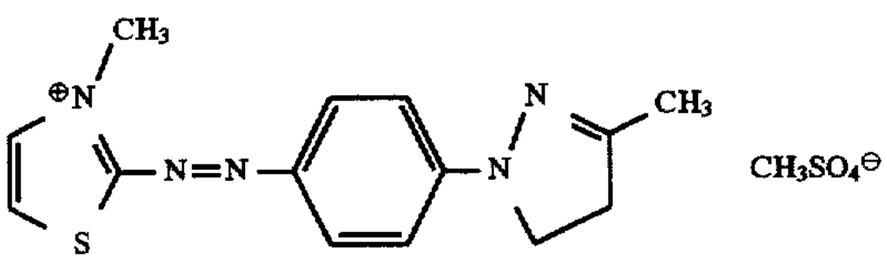
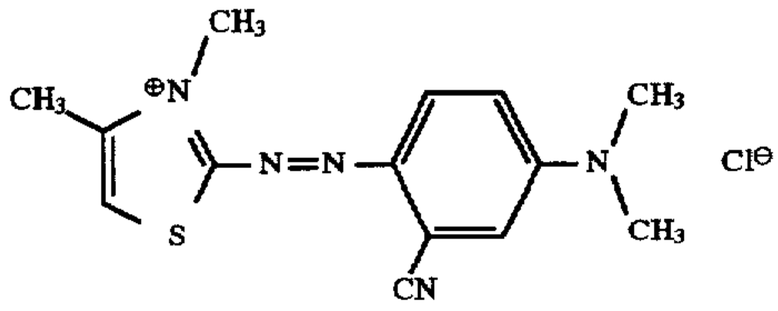
Example	Dye	Hue
20		yellowish orange
21		yellow
22		greenish yellow
23		reddish orange
24		red
25		scarlet
26		golden yellow
27		red
28		red

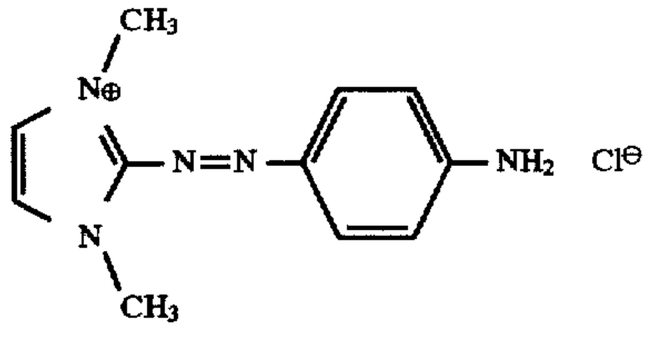
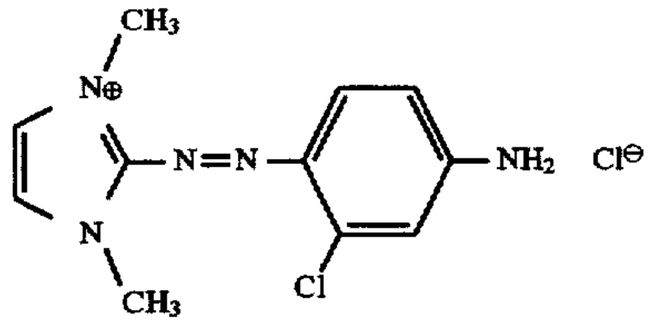
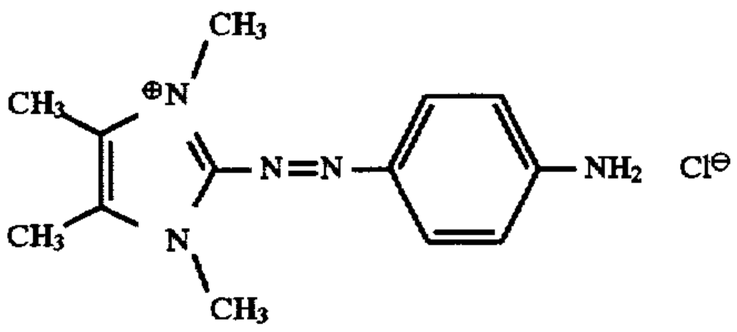
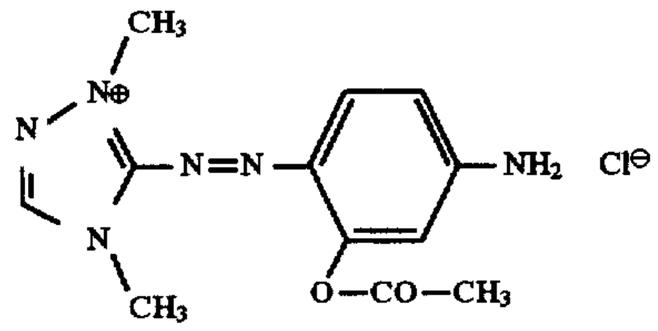
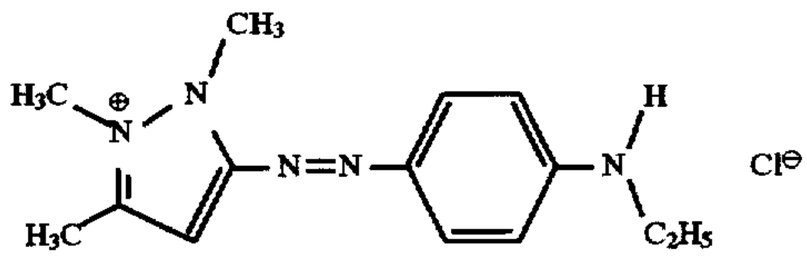
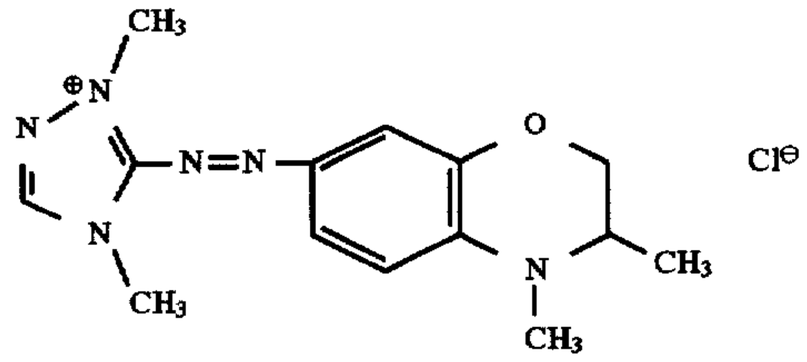
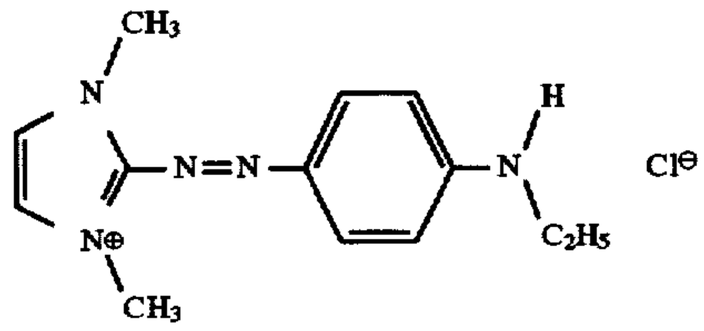
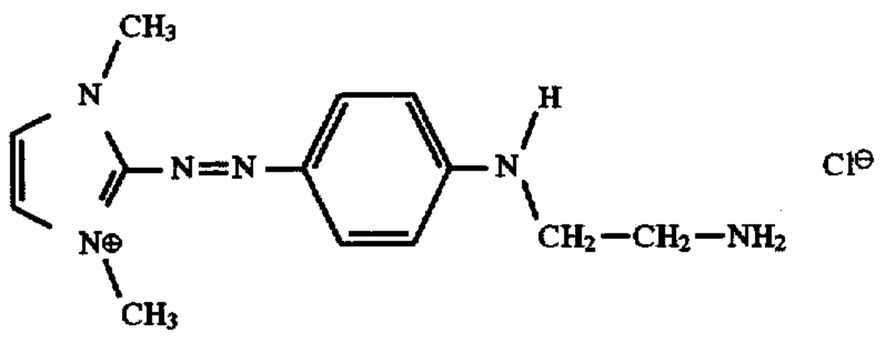
-continued

Example	Dye	Hue
29		red
30		reddish orange
31		red
32		red
33		red
34		blue
35		blue
36		blue

-continued

Example	Dye	Hue
37		blue
38		blue
39		blue
40		blue
41		blue
42		blue
43		blue
44		blue
45		blue

-continued

Example	Dye	Hue
46		orange
47		orange
48		orange
49		reddish orange
50		orange
51		ruby
52		scarlet
53		scarlet

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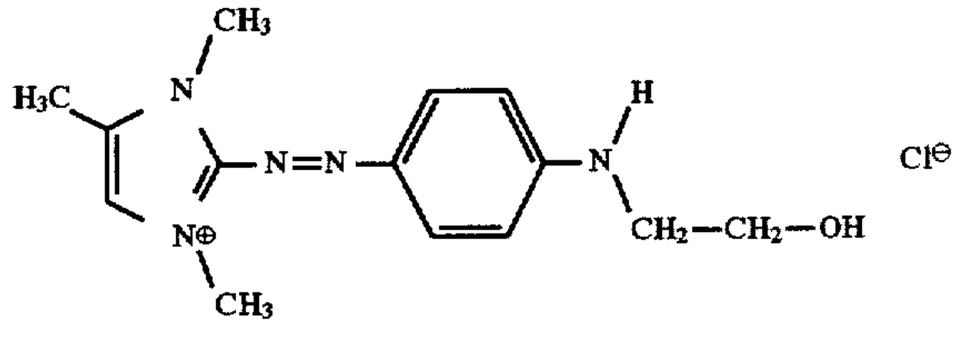
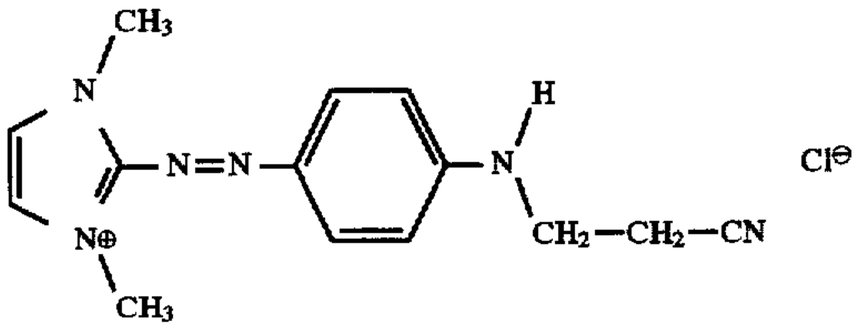
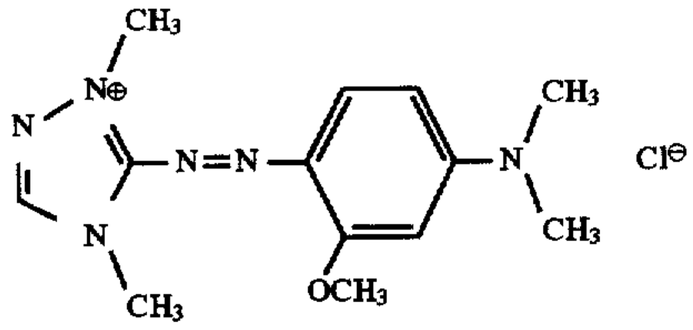
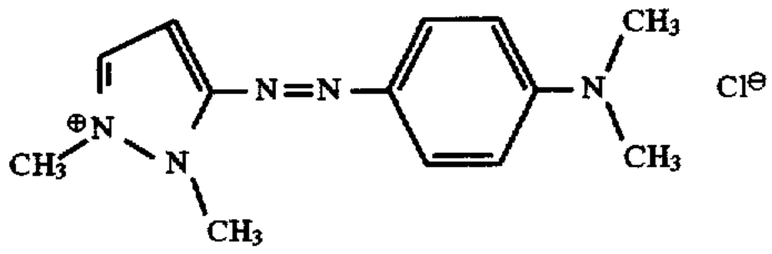
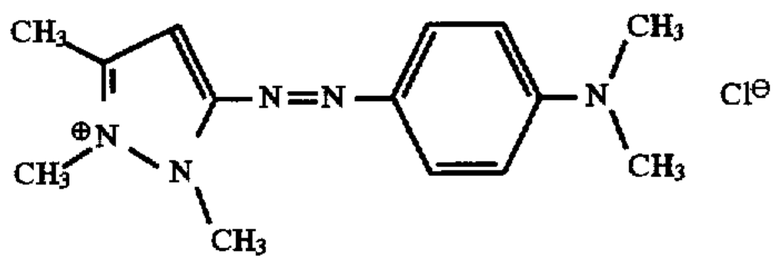
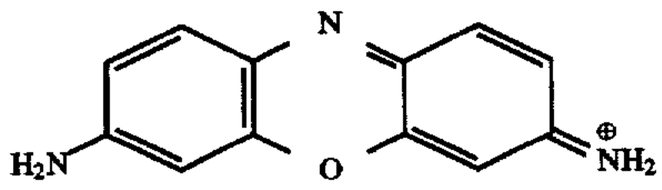
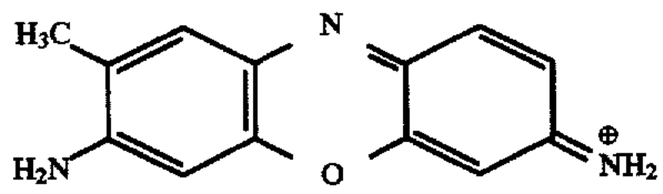
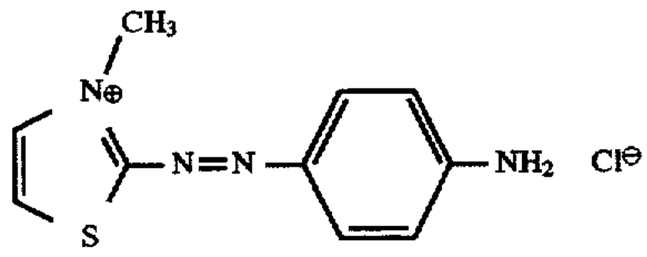
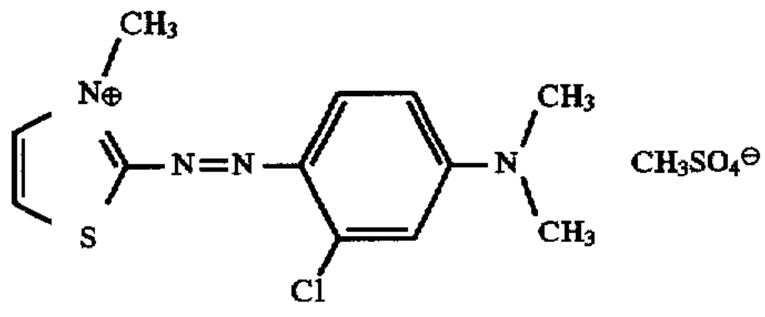
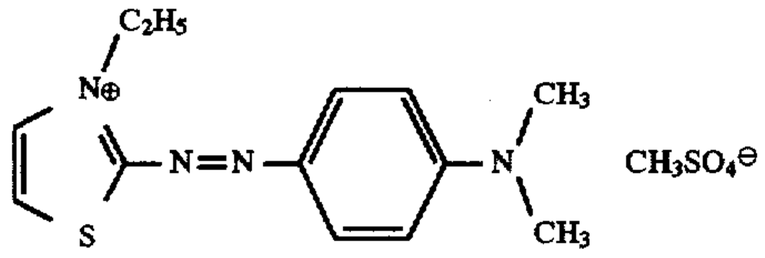
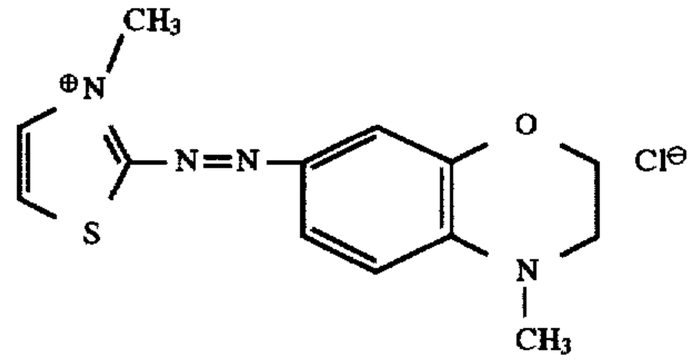
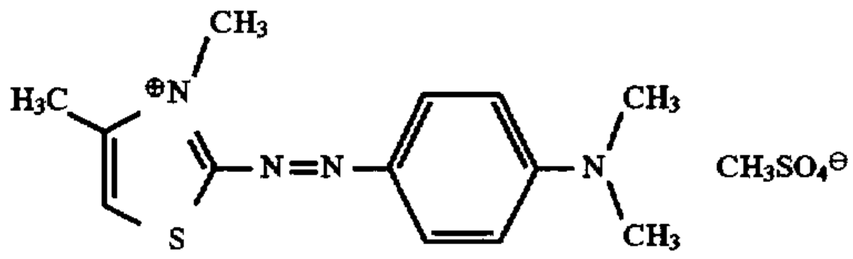
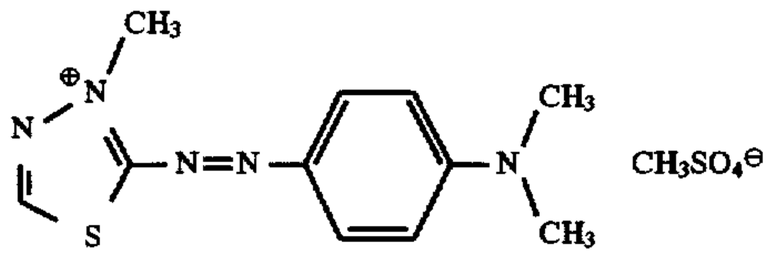
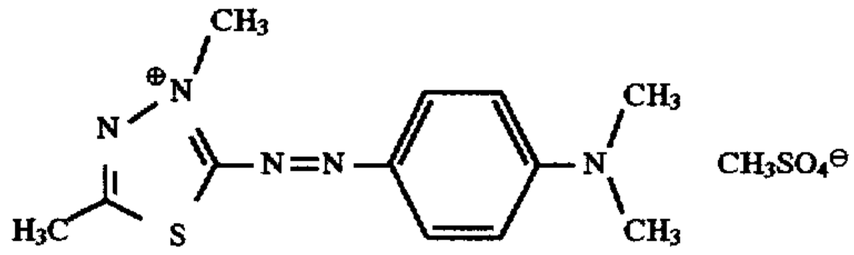
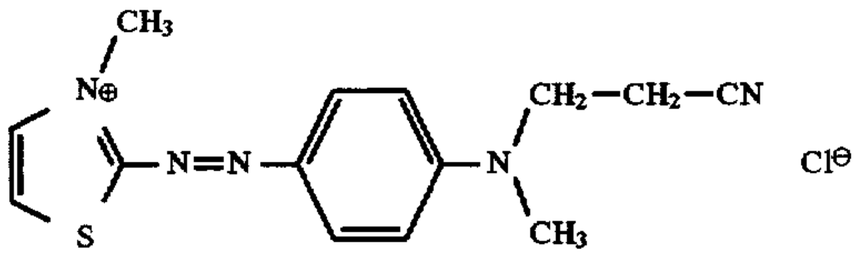
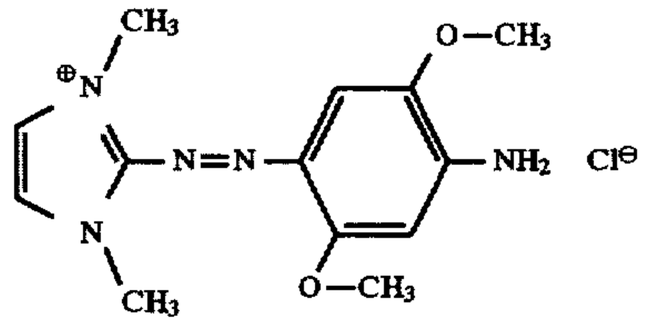
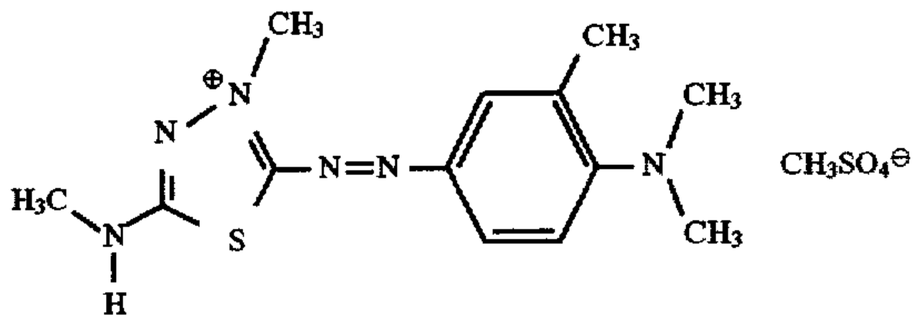
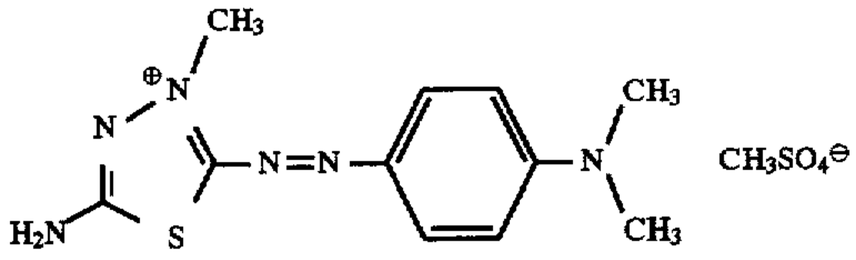
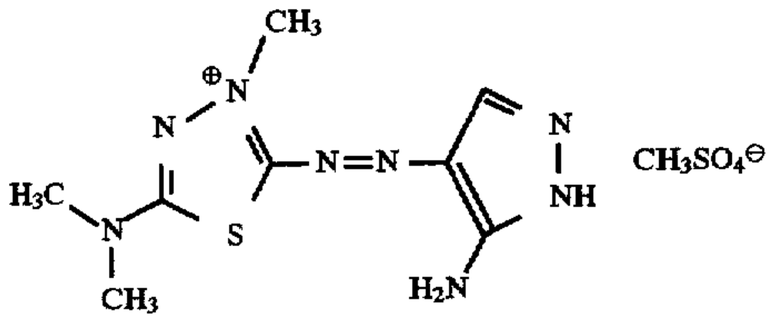
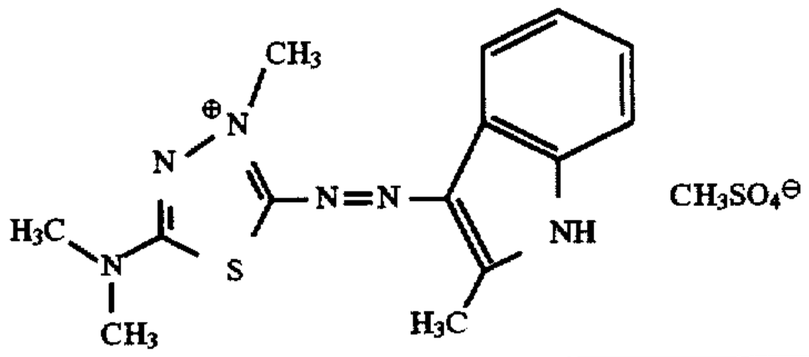
Example	Dye	Hue
54		scarlet
55		scarlet
56		scarlet
57		scarlet
58		scarlet
59		violet
60		violet
61		violet
62		blue

-continued

Example	Dye	Hue
63		blue
64		blue
65		bluish violet
66		bluish violet
67		blue
68		violet
69		violet
70		violet
71		blue

-continued

Example	Dye	Hue
72		blue
73		blue
74		blue
75		red

EXAMPLE 76

A braided strand of blond, natural, untreated human hair is treated at 25° C. for 5 minutes with a dye emulsion which has the same composition as the emulsion in Example 1 but contains as dyes 0.11% of the dye of Example 4 and 0.10% of the dye of Example 5. After the strand of hair has been thoroughly rinsed with water and dried, it has a deep violet colour with very good fastness properties.

EXAMPLE 77

Example 76 is repeated with the dyes replaced by 0.08% of the dye of Example 1 and 0.06% of the dye of Example 5, affording a very brilliant green colouring on the hair.

EXAMPLE 78

0.02% of the dye of Example 1 and 0.08% of the dye of Example 5 are dissolved in a surfactant base comprising a 10% aqueous solution of cocoamphoglycinate and this solution is used to dye a strand of bleached yak hair at room temperature for 5 minutes. A bright, brilliant turquoise shade is obtained on the hair.

EXAMPLE 79

Blond, untreated human hair is treated for 20 minutes at room temperature with a dye emulsion which has the same composition as the emulsion in Example 1 but contains as dyes 0.2% of the dye of Example 1, 0.1% of the dye of Example 4 and 0.17% of the dye of Example 6. Thorough rinsing and drying of the hair leaves a deep black colouring having good fastness properties.

EXAMPLE 80

Example 79 is repeated with the dyes replaced by a dye mixture containing

0.138% of the dye of Example 2,

0.082% of the dye of Example 4 and

0.026% of the dye of Example 6,

affording a chestnut brown colouring.

EXAMPLE 81

Olive-coloured hair is obtained on repeating Example 79 with the following dye mixture:

0.13% of the dye of Example 2,

0.006% of the dye of Example 4 and

0.032% of the dye of Example 6.

EXAMPLE 82

Example 81 is repeated with a dye mixture containing

0.01% of the dye of Example 2,

0.11% of the dye of Example 4 and

0.21% of the dye of Example 6,

affording a dark navy colouring on the hair.

EXAMPLE 83

A surfactant base comprising a 10% aqueous solution of cocoamphoglycinate is used to dissolve

0.036% of the dye of Example 1,

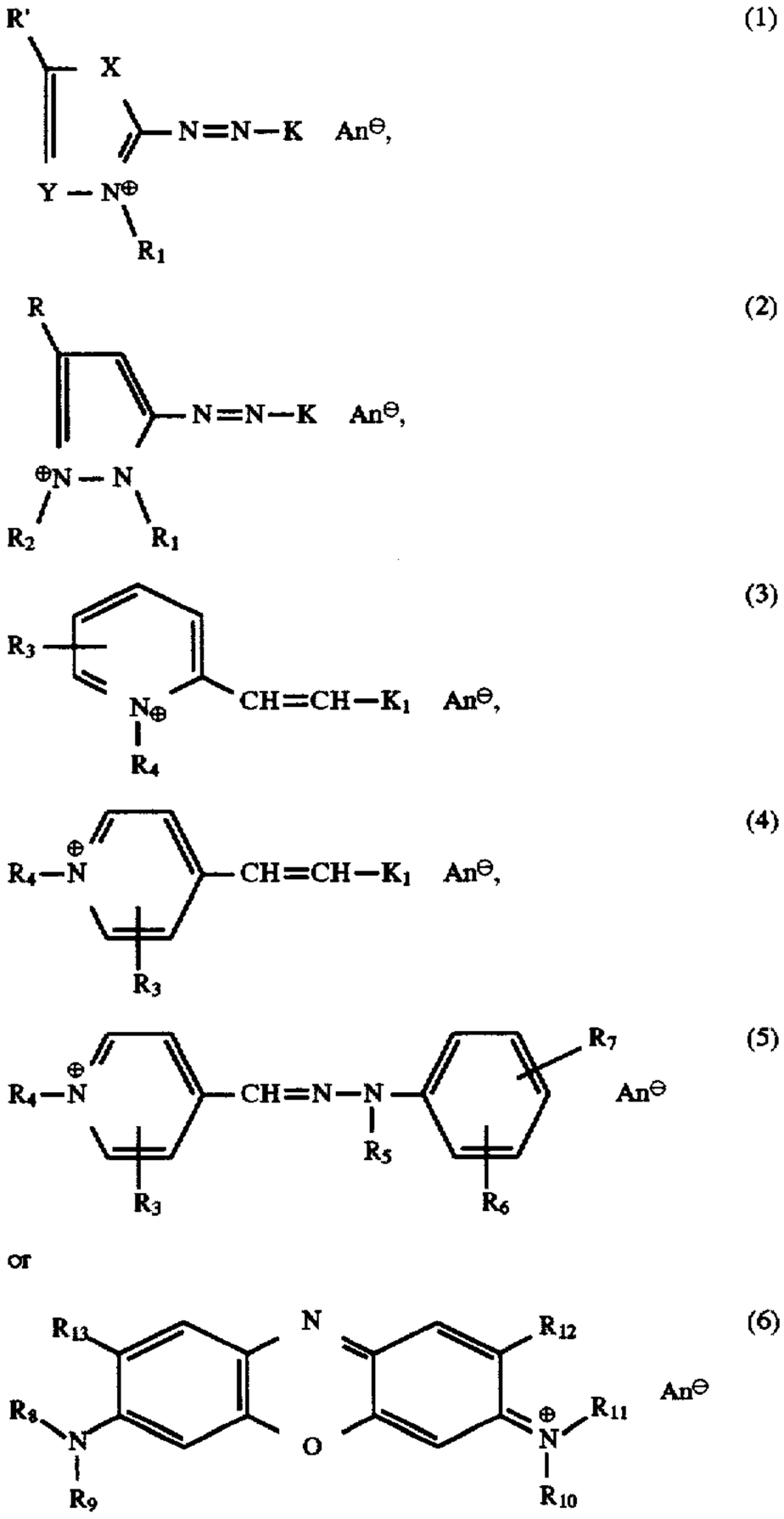
0.034% of the dye of Example 2 and

0.06% of the dye of Example 3

and this solution is used to treat a strand of bleached yak hair for 10 minutes at 25° C. Rinsing and drying leaves a luminously orange dyeing having excellent light, shampooing and friction fastness properties.

What is claimed is:

1. A process for dyeing fibres of human hair, which comprises treating the fibres with a tinctorially effective amount of a dye of the formula



(1)

(2)

(3)

(4)

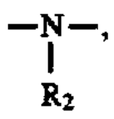
(5)

or

(6)

where

X is



Y is —CH= or

R is hydrogen, C_1–C_4alkyl, Cl or nitro,

R' is hydrogen, C_1–C_4alkyl, Cl, nitro, amino, C_1–C_4monoalkylamino or di-C_1–C_4alkylamino,

R_1 and R_2 are each independently of the other unsubstituted C_1–C_4alkyl or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl,

R_3 is hydrogen, C_1–C_4alkyl or CN,

R_4 is unsubstituted C_1–C_4alkyl or OH—, or CN-substituted C_1–C_4alkyl,

R_5 is hydrogen or C_1–C_4alkyl,

R_6 and R_7 are each independently of the other hydrogen, C_1–C_4alkyl or C_1–C_4alkoxy, or

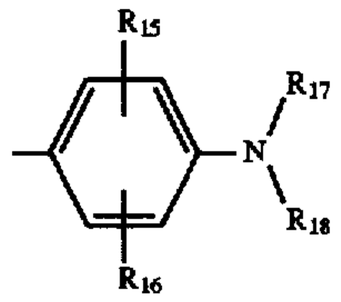
R_5 and R_6 together with the nitrogen and carbon atoms joining them together form a 5- or 6-membered ring,

R_8, R_9, R_{10} and R_{11} are each independently of the others hydrogen or C_1–C_4alkyl, with the proviso that at least one of these 4 substituents is C_1–C_4alkyl and that not all four substituents are ethyl,

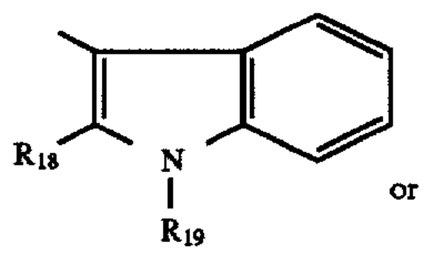
R_{12} and R_{13} are each independently of the other hydrogen, C_1–C_4alkyl or C_1–C_4alkoxy,

K is the radical of a coupling component of the aniline or phenol series or the radical of a heterocyclic coupling component,

K_1 is the radical of an amine of the formula

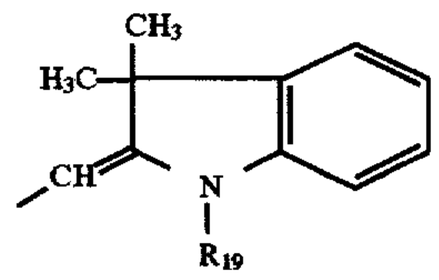


(12)



(13)

or



(14)

where

R_{15} and R_{16} are each independently of the other hydrogen, C_1–C_4alkyl, C_1–C_4alkoxy or halogen,

R_{17} and R_{18} are each independently of the other hydrogen, unsubstituted C_1–C_4alkyl or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl, or

R_{17} and R_{18} together with the nitrogen atom joining them together form a 5- or 6-membered ring, or

R_{15} and R_{17} together with the nitrogen and carbon atoms joining them together form a 5- or 6-membered ring, or

R_{16} and R_{18} together with the nitrogen and carbon atoms joining them together form a 5- or 6-membered ring, and

R_{19} is hydrogen or unsubstituted C_1–C_4alkyl or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl, and

$An^{\ominus}$ is a colourless anion.

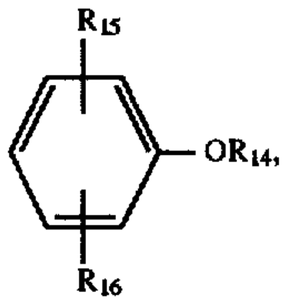
2. A process according to claim **1**, wherein the dye is of the formula (2) where R is hydrogen or C_1–C_4alkyl.

3. A process according to claim **1**, wherein the dye is of the formula (1) or (2) where R_1 is unsubstituted C_1–C_4alkyl.

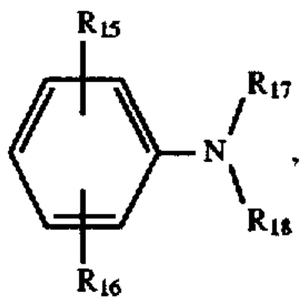
4. A process accounting to claim **1**, wherein the dye is of the formula (1) where R_1 is unsubstituted C_1–C_4alkyl.

5. A process according to claim **1**, wherein the dye is of the formula (1) where Y is —CH=.

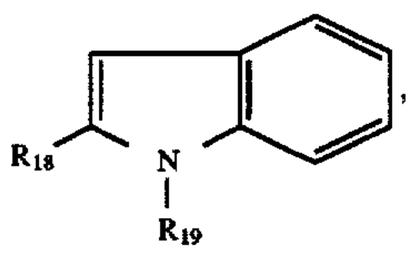
6. A process according to claim 1, wherein the dye is of the formula (1) or (2) where K is the radical of a coupling component of the formula



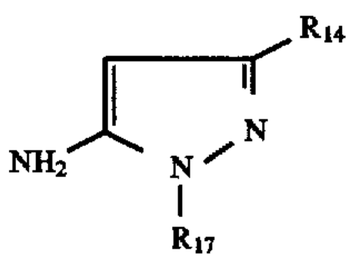
(7)



(8)

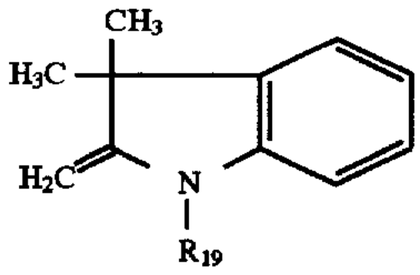


(9)



(10)

or



(11)

where

R_{14} is hydrogen or unsubstituted C_1–C_4alkyl or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl,

R_{15} and R_{16} are each independently of the other hydrogen, C_1–C_4alkyl, C_1–C_4alkoxy or halogen,

R_{17} and R_{18} are each independently of the other hydrogen, unsubstituted C_1–C_4alkyl or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl, or

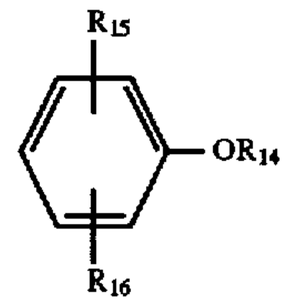
R_{17} and R_{18} together with the nitrogen atom joining them together form a 5- or 6-membered ring, or

R_{15} and R_{17} together with the nitrogen and carbon atoms joining them together form a 5- or 6-membered ring, or

R_{16} and R_{18} together with the nitrogen and carbon atoms joining them together form a 5- or 6-membered ring, and

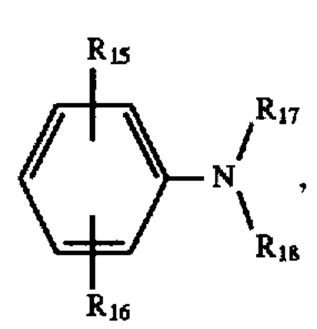
R_{19} is hydrogen or unsubstituted C_1–C_4alkyl or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl.

7. A process according to claim 6, wherein the dye is of the formula (1) where K is the radical of a coupling component of the formula



(7)

or



(8)

where

R_{14} is hydrogen or unsubstituted C_1–C_4alkyl,

R_{15} and R_{16} are each independently of the other hydrogen, C_1–C_4alkyl, C_1–C_4alkoxy or halogen,

R_{17} and R_{18} are each independently of the other hydrogen or unsubstituted C_1–C_4alkyl, or

R_{17} and R_{18} together with the nitrogen atom joining them together form a pyrrolidine, piperidine, morpholine or piperazine ring, or

R_{15} and R_{17} together with the nitrogen and carbon atom joining them together form a pyrrolidine, piperidine, morpholine or piperazine ring, or

R_{16} and R_{18} together with the nitrogen and carbon atom joining them together form a pyrrolidine, piperidine, morpholine or piperazine ring.

8. A process according to claim 7, wherein the dye is of the formula (1) or (2) where K is the radical of a coupling component of the formula (7) or (8) where

R_{14} is methyl or ethyl,

R_{15} and R_{16} are each independently of the other hydrogen, methyl, ethyl, methoxy, ethoxy or chlorine, and

R_{17} and R_{18} are each independently of the other hydrogen, methyl or ethyl.

9. A process according to claim 1, wherein the dye is of the formula (3), (4) or (5) where R_3 is hydrogen or methyl.

10. A process according to claim 1, wherein the dye is of the formula (3), (4) or (5) where R_4 is unsubstituted C_1–C_4alkyl or hydroxyl-substituted C_1–C_4alkyl.

11. A process according to claim 1, wherein the dye is of the formula (3) or (4) where K_1 is the radical of an amine of the formula (12), (13) or (14) where

R_{15} and R_{16} are each independently of the other hydrogen, methyl, ethyl, methoxy, ethoxy or chlorine, or

R_{15} and R_{17} together with the nitrogen and carbon atoms joining them together form a pyrrolidine, piperidine, morpholine or piperazine ring,

R_{17} and R_{18} are each independently of the other hydrogen, methyl or ethyl, and

R_{19} is hydrogen, methyl or ethyl.

12. A process according to claim 1, wherein the dye is of the formula (5) where

R_5 is hydrogen or methyl and R_6 and R_7 are each independently of the other hydrogen, C_1–C_2alkyl or C_1–C_2alkoxy, or

R_5 and R_6 together with the nitrogen and carbon atoms joining them together form a pyrrolidine, piperidine, morpholine or piperazine ring.

13. A process according to claim 1, wherein the dye is of the formula (6) where

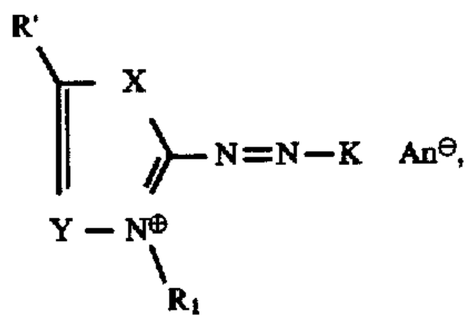
R_8, R_9, R_{10} and R_{11} are each independently of the others hydrogen or C_1–C_2alkyl, with the proviso that at least one of these 4 substituents is C_1–C_2alkyl and that not all four substituents are ethyl, and

R_{12} and R_{13} are each independently of the other hydrogen, C_1–C_2alkyl or C_1–C_2alkoxy.

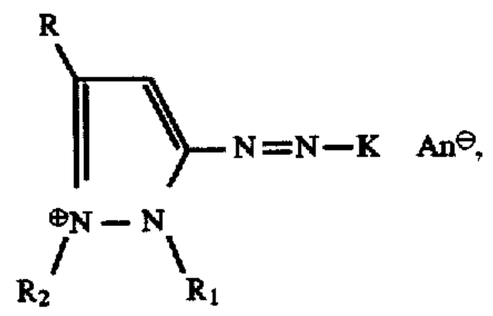
14. A process according to claim **1**, wherein the dye is of the formula (1) where R' is hydrogen, C_1–C_2alkyl, amino, C_1–C_2monoalkylamino or di-C_1–C_2alkylamino.

15. A process for dyeing hairs of humans according to claim **1**, wherein predeterminable shades are determined with colorimetric methods of measurement.

16. A process for dyeing fibres of human hair, wherein the fibres are treated with a tinctorially effective amount of a mixture of cationic dyes of at least two of the formulae



(1)



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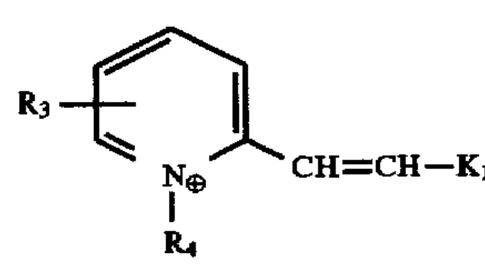

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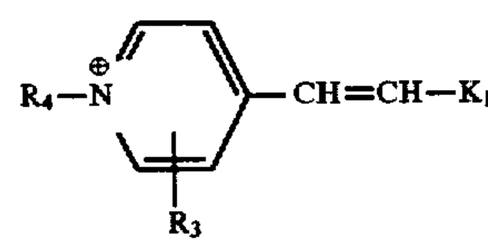
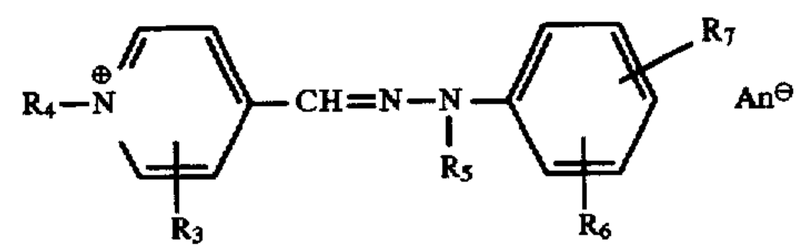
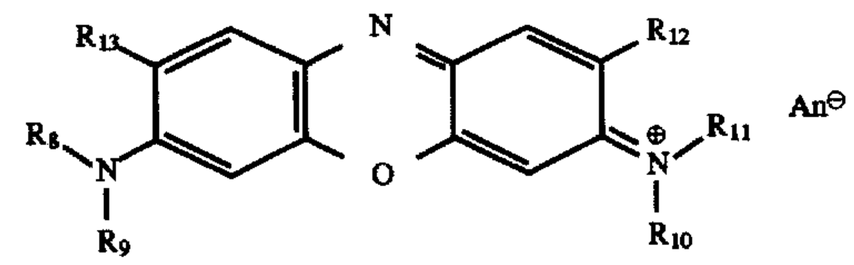


(4)



(5)

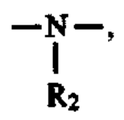
or



(6)

where

X is



Y is —CH═ or

R is hydrogen, C_1–C_4alkyl, Cl or nitro,

R' is hydrogen, C_1–C_4alkyl, Cl, nitro, amino, C_1–C_4monoalkylamino or di-C_1–C_4alkylamino,

R_1 and R_2 are each independently of the other unsubstituted C_1–C_4alkyl or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl,

R_3 is hydrogen, C_1–C_4alkyl or CN,

R_4 is unsubstituted C_1–C_4alkyl or OH— or CN-substituted C_1–C_4alkyl,

R_5 is hydrogen or C_1–C_4alkyl,

R_6 and R_7 are each independently of the other hydrogen, C_1–C_4alkyl or C_1–C_4alkoxy, or

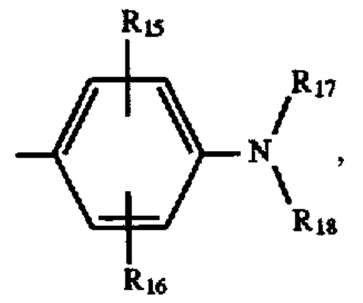
R_5 and R_6 together with the nitrogen and carbon atoms joining them together form a 5- or 6-membered ring,

R_8, R_9, R_{10} and R_{11} are each independently of the others hydrogen or C_1–C_4alkyl,

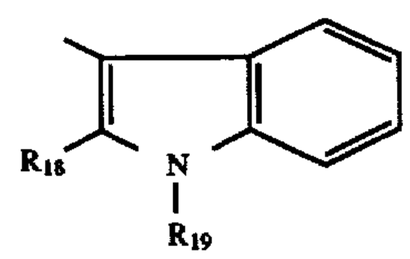
R_{12} and R_{13} are each independently of the other hydrogen, C_1–C_4alkyl or C_1–C_4alkoxy,

K is the radical of a coupling component of the aniline series or the radical of a heterocyclic coupling component,

K_1 the radical of an amine of the formula

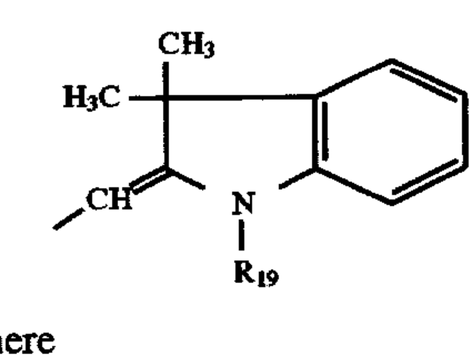


(12)



(13)

or



(14)

where

R_{15} and R_{16} are each independently of the other hydrogen, C_1–C_4alkyl, C_1–C_4alkoxy or halogen,

R_{17} and R_{18} are each independently of the other hydrogen, unsubstituted C_1–C_4alkyl or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl, or

R_{17} and R_{18} together with the nitrogen atom joining them together form a 5- or 6-membered ring, or

R_{15} and R_{17} together with the nitrogen and carbon atoms joining them together form a 5- or 6-membered ring, or

R_{16} and R_{18} together with the nitrogen and carbon atoms joining them together form a 5- or 6-membered ring, and

R_{19} is hydrogen or unsubstituted C_1–C_4alkyl or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl, and

$An^{\ominus}$ is a colourless anion.

17. A process according to claim **16**, wherein the fibres are treated with a mixture of at least two cationic dyes having a delocalized positive charge and a cation molecular weight below 280.

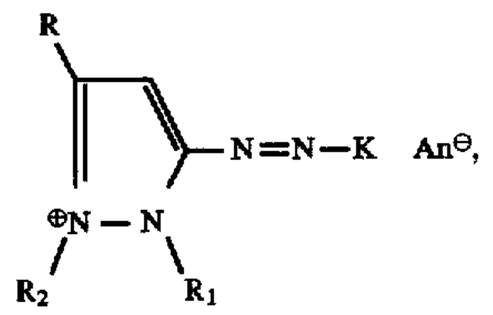
18. A process according to claim **17**, wherein the fibres are treated with a mixture of at least three cationic dyes having a delocalized positive charge and a cation molecular weight below 280.

19. A process according to claim **18**, wherein the fibres are treated with a mixture of a yellow, a red and a blue cationic dye having a delocalized positive charge and a cation molecular weight below 280.

20. A process for dyeing hairs of humans according to claim **16**, which comprises applying to the hairs a mixture of ready-prepared dyes of at least two of the formulae (1) to (6) and wherein predeterminable shades are determined with colorimetric methods of measurement.

21. A process for dyeing hairs of humans according to claim **20**, which comprises applying to the hairs a mixture of a yellow, a red and a blue dye, and wherein predeterminable shades are determined with colorimetric methods of measurement.

22. A process for dyeing fibres of human hair, wherein the fibres are treated with a tinctorially effective amount of a mixture of cationic dyes of at least two of the formulae



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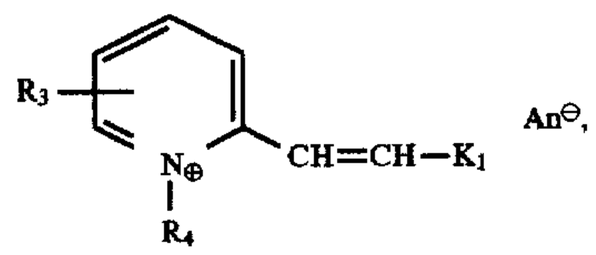

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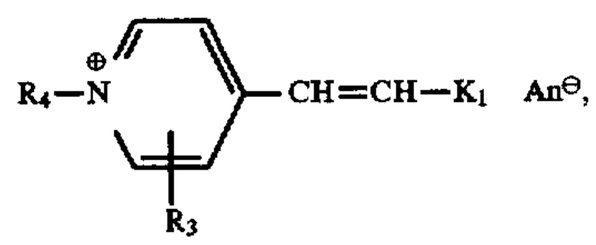

(4)

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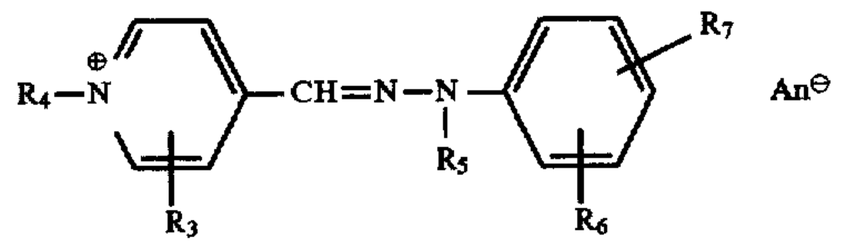
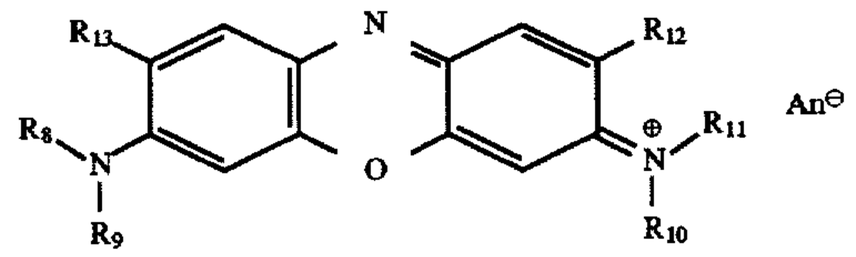


(5)

or



(6)

where

R is hydrogen, C_1–C_4alkyl, Cl or nitro,

R_1 and R_2 are each independently of the other unsubstituted C_1–C_4alkyl or OH—, C_1–C_4alkoxy-, halogen-, CN—, amino-, C_1–C_4monoalkylamino- or di-C_1–C_4alkylamino-substituted C_1–C_4alkyl,

R_3 is hydrogen, C_1–C_4alkyl or CN,

R_4 is unsubstituted C_1–C_4alkyl or OH— or CN-substituted C_1–C_4alkyl,

R_5 is hydrogen or C_1–C_4alkyl,

R_6 and R_7 are each independently of the other hydrogen, C_1–C_4alkyl or C_1–C_4alkoxy, or

R_5 and R_6 together with the nitrogen and carbon atoms joining them together form a 5- or 6-membered ring,

R_8, R_9, R_{10} and R_{11} are each independently of the others hydrogen or C_1–C_4alkyl,

R_{12} and R_{13} are each independently of the other hydrogen, C_1–C_4alkyl or C_1–C_4alkoxy,

K is the radical of a coupling component of the aniline series or the radical of a heterocyclic coupling component,

K_1 is the radical of an aromatic or heterocyclic amine, and

$An^{\ominus}$ is a colourless anion.

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